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THE
LARYNGOSCOPE.

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REVIEW OF RECONSTRUCTIVE SURGERY— 1943-1945.*

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The general interest of the medical profession in plastic surgery has probably never been higher than at the present time, and there have been almost as many articles on this subject in the last two years as there were in the preceding five years. The earnest desire to provide the best possible care for the casualties of this war has undoubtedly been the main stimulus, but it is to be hoped that the interest will survive and even grow after peace has been attained.

Some of the articles have consisted of case reports of well known and standard (or in some instances, antiquated) procedures and this probably reflects the entrance of new persons into the field, or the expansion of interests of those who had been working in some part of the field. Along with this, a number of worthwhile new things have been reported, as well as good discussions of known procedures which will be of help in crystallizing our ideas as to their proper place. The following appeared in the literature between April, 1943, and March, 1945, inclusive.

FACIAL INJURIES.

Excellent books on the treatment of facial injuries have recently been written by Fry, Shepherd, McLeod and Parfitt,[62] and by Erich and Austin.[55] The former group is at the East

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Grinstead unit with McIndoe, and their writings are concerned primarily with their experiences in the care of casualties resulting from this war. The book is clear and concise and intimately describes most all of the major and minor annoyances and complications that may go with this type of work. As noted by J. B. Brown in the foreword, "the very lack of expansive writing naturally puts the reader on the side of the authors."

Erich and Austin's book is in atlas form and is profusely illustrated with unusually clear photographs and drawings. Brevity and directness, as well as its format, make it valuable as a quick reference, and it is certain to find wide use in this field.

The general principles of early care of facial injuries have been discussed by several authors. Kirkham[88] notes that there is no essential difference in plastic procedures as performed in civil life from those in military practice, but that there is a variation in the types of cases encountered and in the situations under which care must be given. J. B. Brown[88] lists as fundamentals: *1.* conservative debridement, *2.* not packing face wounds open (gas gangrene doesn't develop in the face), *3.* sulfonamides are usually better administered systemically than locally, *4.* early bone replacement is important, *5.* hemorrhage is best controlled by packing or clamping (ligation of major neck vessels is usually of little avail), *6.* tracheotomies can usually be avoided by intelligent clearance of the airways, *7.* large doses of morphine are not recommended. MacFee[110] has found that primary closure, rather than packing open, is often indicated — especially in wounds of the face — and believes that the decision should be governed by circumstances in each case and not wholly restricted by rule.

Myers[132] has been stationed in the South Pacific and has found that facial wounds are relatively uncommon, 80 cases being admitted to the head and neck ward of his hospital in four months. Most had their wounds packed open with sulfa powder on arrival. As soon as possible, these were irrigated, redusted with sulfa drugs, and warm saline compresses applied externally for a few days, after which they were closed secondarily. Most of the wounds infected on admission

were those which had had primary suturing at some forward station. Fractured jaws were usually immobilized by the dental corps and the soft tissue wounds were packed open. The main complications seen were: *1.* infection, *2.* obstruction of airways (four had tracheotomy tubes in on arrival), *3.* secondary hemorrhage. He favors treating all wounds, in an installation such as his, as though they were infected on arrival and observing them for a few days before doing a secondary closure.

In a comparison of battle casualties with street or industrial wounds of the face, Blair[16] recommends the following for the former: *1.* establishment of a free airway, control of bleeding and shock; *2.* restoration of bony framework; *3.* wounds in the floor of the mouth should not be closed; *4.* soft tissue closure can be done, especially of lips, nostrils, alae, columella, ears, eyelids, trap door flaps of skin, and displacement of nasal cartilages or mucosa—in widespread loss, it may be better to tack mucosa to the skin than to just pack open; *5.* the widespread, "classic" debridement should not be done; *6.* burns should be made ready for split grafting at earliest possible date.

Gallagher[64] outlines the treatment of facial wounds in military casualties from the front areas to the rear zones as to limitations, advantages sought, essential equipment and harmful procedures to avoid.

Mullen[121] relates his experiences in the last war and Kazanjian[95] has recorded the case histories of several patients seen in that war. The latter concluded that: *1.* care is more effective when patients are segregated into designated centers; *2.* all gunshot wounds are infected from the beginning and should be treated as such; *3.* wounds should not be sutured until infection has subsided; *4.* immobilization of jaw fractures should be carried out early, preferably within the first week or two; *5.* early complications to be watched for include local abscesses, general sepsis, bronchopneumonia, erysipelas and secondary hemorrhage. Oldfield,[136] from his experiences in the British army in this war, concludes that a facial wound should be sutured only if it is recent and there is no skin loss. If there is skin loss, he favors packing it open with sulfanilamide, except in perforating cheek losses in which the

skin may be sutured to the mucosa. He advocates conservatism in debridement, especially as regards the facial bones.

In fractures of the bones of the face, Rank[150] likes McIndoe's classification of frontal violence (nasomaxillary compound), and lateral violence (malar-maxillary compound), injuries. He follows McIndoe's teachings in their treatment (as outlined in the book by Fry, et al.[62]), and also notes that a very simple anesthetic apparatus can be used in forward areas. This consists of a Magill endotracheal catheter connected by two or three feet of rubber tubing to a Flagg can and may be used with ether or chloroform. Coakley and White[33] note that they have obtained the best results in fractures of the zygoma when the reduction was undertaken within the first six to 10 days and that in this period it is simple either by the temporal or mouth approach. Johnson[91] reports a case of a depressed orbital floor which was reduced through the Caldwell-Luc approach and maintained up in position by a water-inflated balloon in the antrum. This permitted checking the position by X-ray at intervals of a few days and putting more water in the balloon if necessary.

Broesamle[18] reviews the various methods of interdental fixation for fractures of the mandible, and Doherty[50] states that this is all that is necessary in the usual case with a fractured condyle. Dalling[41] prefers interdental wiring for immediate fixation, to be replaced later with cast cap splints as a long term policy. Parker[138] relates his experiences with the external bar fixation (Roger Anderson and Haynes-Griffin splints) and Winter[192] describes the use of the Roger Anderson apparatus in 50 cases. Winter has had no infections, but considerable "pin seepage" from all of them. He advocates it for the fixation of elevated posterior fragments or for edentulous jaws and thinks that one can elect to use it in cases amenable to interdental wiring, with the proviso that it should not be used in children because of the unerupted tooth buds. Strock[174] likes to avoid the use of external skeletal fixation, instead doing direct wiring of edentulous fragments with ticonium or tantalum. He puts the wires in through the mouth, using dental burrs and drills and doesn't plan on taking them out later.

Coakley and Baker[34] report their experiences with 212 jaw

fractures, 191 lower, 16 upper and six, both. Thirty-one per cent had osteomyelitis and of these, 30 separated sequestra. Most of them were treated by interdental wiring. They tried Ivy's method for elevated posterior fragments (plaster head-cap with a coat hanger hook and elastic traction to a wire in the angle) in 11 cases and obtained unsatisfactory results in six, including nonunion, malposition and infection. They have since discontinued it and have used internal wire (Kirschner) fixation in several with good results.

Cuthbert[38] has found that multiple tiny comminuted fragments in mandibular fractures do not remain viable and are apt to be a source of trouble. In 11 badly comminuted cases treated by interdental wiring in 1941, there were five cases of nonunion and those that united were slow and had prolonged drainage and separation of sequestra. In 14 similar cases in 1942-1943, all were opened up and all small bone fragments removed. All healed promptly except five cases of gross comminution in which no attempt was made at primary union. These were allowed to heal by granulation and bone grafting was done later, obtaining final union within 10 to 20 weeks after the injury. Converse[31] has reviewed the procedures used in the American Hospital in Britain and stresses the use of sulfonamides.

There have been a number of interesting reports from the Russian army. Aronovich[2] has seen 12 cases of gunshot wounds of the lower jaw with spinal complications, these ranging from direct bullet injury to the cord or vertebrae to cervical fractures resulting indirectly from explosive violence in the area. He states that they are often missed on the preliminary examination because the face injuries are so evident and the patient often has difficulty in talking. Entin[54] described his experiences in the Finnish war and in the present war with the delayed closure of granulating wounds by means of wire sutures and buttons. These are usually placed 10 to 20 days after the injury and gradually tightened, and are often removed in eight to 12 days. He felt that their use materially hastened the closure of these wounds. Rauer[151] performed delayed closure of granulating wounds on the eighth to twelfth day in 150 cases of maxillofacial wounds and obtained smooth uneventful healing in 87 per cent. There

was some separation not interfering with union in 10 per cent and partial or total disruption in 3 per cent.

Weisengreen[190] describes the uses of heat, cold, light, electrotherapy and massage in face injuries. Van Zile[182] has developed a variation of the plaster headcap-coat hanger apparatus and Stevenson[171] has devised a metal head band with wires attached by U-clamps. Pincock[144] has made a pin guide which helps him in inserting Kirschner wires in lower jaw fractures.

FACIAL PARALYSIS.

Coleman[27] has been able to do successful secondary sutures of individual branches of the facial nerve in some instances, and his illustrations show some excellent results. When he was not able to do this, he used the faciohypoglossal anastomosis, or Brown's fascial strip connections to the temporalis muscle, or both. In one case he sutured the eye and cheek branches and used the fascial strips for the mouth; in another, he sutured the eye and cheek branches to the main VIIth nerve trunk and the mandibular branch to the XIth nerve. He has also noted the difficulty encountered with mass movements in some patients following anastomoses to other cranial nerves or the suturing of the main trunk. Dandy and Hanrahan[42] have combined XIth nerve anastomosis with Brown's fascial strip operation, all in one stage, but use the combined operation only in cases of less than one year's duration. In older cases, they use the fascial strip operation alone. Lamont[103] uses Brown's fascial strip procedure combined with a unilateral face lifting operation, all in one stage. Schuessler[161] has modified the fascial operation by substituting tantalum wire for the strips, and uses buttons of tantalum foil at either end to prevent the wires from cutting through.

Kettel[97] reports 264 cases of facial paralysis of otitic origin from Copenhagen. The various operations used include: *1.* decompression of the canal, *2.* direct suturing (rerouting the nerve if necessary), *3.* free nerve grafts, *4.* plastic operations (especially late when the muscles have degenerated). Violé believes that in facial paralysis with acute otitis, surgery is justified only if indications for mastoidectomy are

present. In Bell's palsy, the indications for immediate surgery are questionable, regardless of the findings in the faradic test (which he finds unreliable). In facial paralysis with a definite traumatic history, exploration is warranted, as it is also in the presence of chronic suppuration. He feels that suturing is better than just laying the ends together in any case, and reviews his experiences with rerouting the nerve, decompression of the canal, end-to-end anastomosis and free nerve grafts. Decker[46] points out that impairment of the nerve may occur in the Fallopian canal or the facial canal. The Fallopian canal wall is very thin and edema of the nerve in this area may subside following myringotomy and satisfactory drainage. In acute otitis media, paralysis coming on late as indicative of bone necrosis and subsequent surgery is indicated. In chronic otitis media, facial paralysis is a definite indication for surgical intervention. Furstenberg[63] prefers direct suturing to free grafts or anastomoses when possible and thinks that the procedure of lifting the nerve out of the bony canal and rerouting it through the parotid region to shorten its course and permit direct suturing should be used more often.

McCall and Gardiner[120] report three cases of facial paralysis successfully treated. Dahlberg[39] has devised a plastic cradle to temporarily hold the angle of the mouth back. Instead of hooking it to the ear or a headband, he has connected it by a rubber band to a hook on the upper last molar tooth.

NOSE.

The advisability of rhinoplasty in various situations has been discussed by several writers. Wolf[193] has found that rhinitis sicca and atrophic rhinitis are often helped by this operation and believes that this is due to reducing the size of the air chambers and thereby establishing more normal air currents. G. V. Webster[186] discusses the place of the operation in military practice and believes that it is indicated for correction of injuries sustained on active duty, or when a pre-existing deformity is a hazard through airway obstruction or extreme neurosis. Proetz[147] reviews the physiology of the nose, especially as regards the normal direction of air currents and ciliary activity, and believes that all incisions

should be planned so that any resultant scars will not interfere with these. Griesman[76] has studied the various muscles acting upon the nose and believes that the incisions should be planned so as not to injure them.

Aufricht[3] has made some excellent suggestions which he modestly labels "a few hints and surgical details," and anyone doing this type of work would do well to read his article. *1.* He uses eight standard photographs for records — both profiles, front and bottom views in repose and laughing. *2.* He draws an outline of the planned profile on the skin of the nose at operation with methylene blue or mercurochrome. This does not replace photographs, casts, measurements or preliminary study, but is useful as a last minute review and enables one to get the "feel" of the individual nose just before doing it. *3.* He uses a fine chisel to separate the upper end of the nasal bones from the septum (when the hump doesn't go up that high) and then levers it outward to produce an "outfracture" of the bones. This prevents any "greenstick" tendency in the subsequent infracturing and produces a cleaner fracture with less chance of any attached projecting spicules being left on the radix nasi. If the radix nasi is too wide, he resects a strip of bone from it with the fine chisel, pulls it out with a forceps, and does the outfracturing at a higher level. *4.* He describes a variety of geometrical patterns which may be resected from the nostril floor, or the base of the ala, or both, to correct the shape of the nostrils. *5.* To correct any webbing between the columella and lip, after removing any bone or cartilaginous prominence of the nasal spine, he uses a special submerged suture to draw the base of the columella snugly up against the spine. *6.* He prefers Scotch tape for strapping the tip postoperatively, as one can see the shape of the tip through it and note by any blanching of the skin whether the tape is too tight or not. *7.* He packs the nostrils around Dakin's tubes to permit the patient to breathe through the nose and provide drainage. By doing this, he believes it is safe and advisable to leave the packs in for three or four days.

Several authors have noted that plastic procedures upon the septum are at times more advisable than widespread resections. Seltzer[163] hinges angulations out straight and does

a complete osteoplastic operation to allow the tip cartilages to slide over in place (similar to the Metzenbaum operation). Salinger[155] does an osteoplastic procedure and shifts the septum back into place as much as possible, doing as little in the way of resection as is compatible with good airways. In acute injuries, he straightens the nose and septum up, evacuates any hematoma from the septum, and packs the nose with dental wax plugs containing a strip of sheet copper for stiffening. An external splint is also applied to hold the bones and cartilages in place. Bolotow[17] advocates a submucous resection when the blockage is due to bony septum, but does various plastic procedures when the obstruction is near or around the vestibule. He illustrates shortening the nose, advancing the columella on the septum, swinging a hinged septum over into the midline, and other standard procedures. Ersner[56] calls attention to the frequency of nasal injuries in newborns following dystocia. The most common injury is lateral dislocation of the septal cartilage from the vomerian groove. He states that it should be corrected immediately, manually or with instruments. It usually slides back into place easily, often with an audible click.

Seltzer[162] has used the preliminary outfracturing described by Aufricht, and Daley[40] has used the submerged suture, also described by Aufricht, to eliminate webbing at the columellar-lip angle, and they like these procedures. Maliniac[112] describes the procedure of folding wings of the upper lateral cartilages over the top of the septum to procure moderate elevations of the dorsum of the nose. To procure a more definitive angle between the glabella and nose in a patient with a high sloping hump or a Grecian nose, Mootnick[120] saws the hump off with the tip of the saw down where he desires the new angle. The superior attachment of the hump is then cut loose with a small chisel. Lamont[99] reviews various procedures for the correction of congenital deformities, as well as those resulting from injury or disease. Berson[12,14] has devised a new rhinometer and Kayser[94] has a new hooked grooved director for pulling the alar cartilage down out of the vestibule and cutting it.

Gillies[65] states that three procedures have been used for reconstruction of large alar defects. These are: *1.* a local

flap turned down for lining and a covering flap from a distance, *2.* a forehead flap with a skin graft lining on the under surface, *3.* an extra length of the covering flap turned in for lining. He describes a new procedure in which he uses part of the anterior skin of the ear and conchal cartilage to replace nostril lining and alar cartilage respectively. The section of conchal cartilage with the overlying anterior skin is removed in one piece and buried under a forehead flap. The forehead flap, with the attached ear cartilage and skin, is brought down later to replace the full thickness of the alar defect. The defect in the ear skin is covered with a free full thickness graft. The results shown are quite nice and he seems as surprised as anyone that the thick free graft of cartilage and skin would survive under a forehead flap. Lamont[102] describes the repair of an alar defect by turning down a local flap for lining, using a free full thickness graft for covering, and later inserting necrocartilage (rib) for support. Barsky[6] has repaired a small alar defect by turning down a local flap for lining, and swinging up a small pedicled flap from the side of the columella for covering. The defect on the columella was covered with a split graft. Maltz[113] illustrates a small skin loss on the tip of the nose that was covered by raising a small tubed flap (with the raw side out) over the "anatomical snuff box" of the hand and bringing it up to the nose. He thought that free grafts could be used, but that the circulation on the nasal tip would be risky.

Jervey[90] reports a child who at the age of six months had complete atresia of both nasal airways about one-fourth inch in from the anterior naris. Nothing was done and at the age of five years he had a definite web on the right side with a 2 mm. opening and the left side was still completely occluded. He had the mother gradually dilate the right side with rubber tubes of increasing caliber. On the left side, he cut through the web, packed it open, and used similar rubber tubes later. Result seemed satisfactory five weeks after operation. Berkove[11] reports a case of hypertelorism and notes that no treatment is necessary or possible except plastic procedures on the nose and operative correction of the associated strabismus.

EYELIDS AND ORBIT.

Cordes and Fritschi[35] have performed the Dickey operation for ptosis on 30 eyelids in 21 patients. It can be used in patients with a normal superior rectus muscle, or slight weakness, but should not be used in the presence of marked weakness. The operation consists essentially of inserting a sling of fascia through the middle of the muscle and attaching it to the lid and they feel that it gives a better attachment than the Motais, Blaskovics or Trainor operations. They have used it at nearly all ages, the youngest patient at 13 months, and show quite nice results. Complications were limited to early corneal inflammations in three and diplopia in four. Of the latter, one disappeared following correction of the other eye, in two it was present only on extreme elevation of the lid, and in the remaining one it was present only at intervals. Ellis[53] uses O'Connor's modification of the Motais operation and combines it with one of the deep suture (Pagenstecher) operations for supporting the lid.

Sugar[175] reports two cases in which he used a modification of Hughes' tarsoconjunctival sliding graft operation for the repair of defects in the lower lid. He splits the upper lid into two layers, an outer one of skin and orbicularis, and an inner one of tarsus and conjunctiva. Two parallel vertical cuts (the width of the lower lid defect) are made in the inner layer and it is pulled down as a flap and sutured into an incision that splits the mucocutaneous junction of the defect. A prosthesis is left in the socket to provide form, and covering is obtained by sliding a skin flap up from the cheek. He later inserted a hair bearing strip of graft for lashes, and at a third operation separated the lids. Kirby[98] has described the repair and prevention of vertical shortening deformities of the lids, quoting mostly from the writings of Wheeler. Potter[145] had a Mexican boy with bilateral congenital colobomata of the upper lids. They were repaired by freeing the lateral palpebral ligaments, undermining tissue in the zygomatic regions, and sliding flaps over.

Converse[30] had a patient with a displaced internal canthus in which he chiseled out some of the displaced, protruding bone and then anchored the internal palpebral ligament to the

periosteum with 35 gauge stainless steel wire. He had another one with a depressed orbital floor in which he used bone graft (ilium) to elevate the globe. Dimitry[48] points out the advantages of the plastic eye over a glass one, and describes the best method of enucleation and problems in fitting prostheses.

EARS.

Young[194] emphasizes the importance of excising the excess skin from the scaphal side of the incision, when setting back prominent ears, so that the scar will be in the angle between the concha and scapha. He makes the original cartilage incision through the antihelix and superior border of the triangular space, then removes an ellipse of cartilage, staying on the scaphal side of the incision superiorly and on the conchal side inferiorly. He then incises the inferior border of the triangular space, sets the ear back, and excises the skin overflap from the scaphal side.

Lamont[100] has studied the use of necrocartilage in reconstructing missing ears and concludes that it is a foreign body but that the host makes no effort to expel it. He found that both fresh autocartilage and necrocartilage, which had been stored for several months, are often invaded by fibrous tissue. Suraci[176] shows one ear reconstruction that is partly finished, a keloid excision and a laceration repair, and a defect of the helix repaired by a postauricular flap. Greeley[74] advises naval medical officers to save any avulsed ears, dissect the cartilage out of them, and bury them in the abdominal walls of the patient for possible future use in the reconstruction.

Cohen and Fox[26] discuss the management of atresia of the external auditory canal. They think it is perhaps best to leave it alone, when unilateral, as the hearing is usually fairly good and it is rare for these patients to develop any infections of the middle ear or mastoid. In bilateral cases, early operation (even before age of three months) is advocated because of the great handicap of severe loss of hearing. They go in behind the ear, dissect out the cartilaginous and bony canal, separate them, and then remove the posterosuperior wall of the bony canal with an electric burr. The postauricular incision is closed and then they open on three sides of

the occluding web and turn it inward into the canal as a flap and keep the canal packed open for several weeks.

CLEFT LIPS AND PALATES.

Brown and McDowell[21] describe a simple design for the repair of the single cleft lip which they feel produces uniformly good results. The Mirault flap is smaller than that used formerly, sacrifices less lip and produces the extra fullness where it is most needed down close to the vermilion border. Nostril rotation towards the columella is important, as well as getting it up and forward. There is a definite method for locating each point and it has simplified the teaching of the operation to members of the house staff and others who are interested.

A. D. Davis and Selleck[43] note the importance of secondary repairs of lips and palates. They often use Abbé flaps for the correction of tight, retruded lips, following them in some instances with intraoral skin grafts to deepen and free the labial sulcus and a dental prosthesis to hold the lip forward. Rhinoplasty is helpful when the patient has both a large protruding nose and an insufficiency of upper lip. Mansie[114] also uses the skin graft in the sulcus and dental prosthesis when necessary.

Vaughan[183] uses silver ribbon stay sutures in primary closure of cleft palates and sometimes elongates complete clefts at a subsequent operation by doing a sort of V-Y procedure, leaving the tissue intact over the oral surface of the hard palate cleft. He does a two-stage Dorrance pushback operation for the elongation of incompletely cleft palate.

Straith and Patton[172] encountered a family in which there were congenital lower lip pits associated with cleft lips or palate in six out of the 13 members of three generations.

JAWS.

New and Erich[133] point out the importance of immobilizing both major fragments, and of complete asepsis, in doing bone grafts to the jaw. They use cast silver dental splints, extraoral appliances, or both, and note that the appliance must also provide for correct occlusion when teeth are present.

Ivy's method (plaster headcap with a coat hanger hook connected by a rubber band to a wire in the angle) is used for immobilizing edentulous posterior fragments. The greatest difficulty comes when both fragments are edentulous and they use wires in both fragments suspended to a plaster headcap. The bone graft is usually procured from the ilium, sometimes rib, and is fixed in place with catgut sutures.

Thoma[179] has devised a Y-shaped osteotomy for the correction of open bite in adults and states that it allows one to tilt the anterior fragment up and still have more bone in contact than is possible with the ordinary V-osteotomy. Berger[10] advocates the standard conservative treatment for osteomyelitis of the jaws, drainage of the surrounding soft tissues and waiting for sequestra to separate before doing any bone removal.

Costen[36] states that the diagnosis of mandibular joint neuralgia should be considered in any case of facial pain or headache not otherwise accountable. The symptom complex embraces some or all of the usual distributions of Vth nerve pain. The syndrome belongs in the reflex, or secondary, group of neuralgias in which mechanical irritation of branches reflects pain to standard cranial areas. McLaren[126] saw a patient with a painful temporomandibular joint who had been a sparring partner and had had repeated blows to the chin for 15 years. The X-ray showed a circular area of degeneration on the superior aspect of the condyle and removal of the condyle gave complete relief.

L. D. Smith[169] describes an operation for correction of recurrent dislocation of the jaw in which he puts a shoulder bone peg into the articular eminence. Entrance to the area is obtained by him through a vertical incision one inch in front of the ear and the only complication has been temporary facial paralysis.

OTHER FACIAL REPAIRS.

Owens[137] depicts a simplified operation for complete reconstruction of the lower lip in which he swings direct flaps up from either side of the chin (full thickness except mucosa) and sutures them together in the midline. Lining and ver-

milion are provided by mucosal flaps swung down from the cheek on either side. May[128] removes large tumors of the lower lip by a heart-shaped excision and then rotates cheek flaps in from either side and uses other flaps of buccal mucosa for vermilion.

Barsky[5] reports a case in which he repaired an extensive loss of the middle third of the face, including the entire nose, with a single flap. The entire forehead was used as double pedicled flap, swung on both temporal arteries, and lined with skin graft. An acrylic denture with an acrylic nose form attached to the top of it was inserted to provide skeletal support and contour for the flap.

Ivy[87] and W. B. Davis[44] have reported miscellaneous types of facial repairs. F. Smith[108] believes that the use of free grafts and flaps from a distance in facial repairs should always be considered as a procedure of necessity rather than one of choice. He makes a plea for a better understanding of the various uses of Z plastics, the employment of multiple excisions and the use of flaps of normal tissue from the immediate vicinity of the deformity.

Kazanjian and Holmes[96] discuss the repair of forehead defects resulting from radical operations for osteomyelitis. They advise the use of a hairline incision for the removal of the bone, unless the case is an acute fulminating one in which an inverted T incision extending along both eyebrows can be used. For the late repair, they turn periosteal flaps from the edges of the defect over the dura and then implant either bone, cartilage, vitallium, tantalum or acrylic. They prefer bone or cartilage when practical, using bone for defects up to 2½ inches and cartilage for larger ones. They have used only one tantalum and one acrylic and they have been put in too recently to know their ultimate fate, but one vitallium transplant has already been removed. They note that vitallium and the acrylics must be precast and only slight alterations can be made at the operation. Sheet tantalum is also preformed, but it can be altered more at the operation. It has the disadvantage of leaving a dead space between it and the dura, which may prove troublesome. The inert inserts must be subjected to the test of time before final judgment can

be passed as to their ultimate fate. Sheehan[165] also warns against the use of foreign body inserts.

Gurdjian, J. E. Webster and J. C. Brown[79] have used an acrylic (plexiglass) for the repair of a large skull defect. Positive and negative molds were made and the acrylic was precast. It was sterilized in 95 per cent alcohol for 24 hours before operation and was held in place with wire sutures through drill holes. The photographs one year later show a nice result at that time. A. M. Brown[20] has used acrylic implants subcutaneously in the chin, but doesn't state how long the patients have been followed. He sterilizes the implants in bichloride of mercury solution.

Hollander and Shelton[85] excised a refractory area of lupus vulgaris from an upper lip and replaced it with a full thickness skin graft. The graft took nicely and was in good condition at the time of their report, a little less than a year later. Figi, New and Dix[57] point out that surgical excision is the only means of controlling radiodermatitis when secondary changes are pronounced, and it is preferable to do it before the onset of malignancy. Repair of the resultant defect may be by suturing, free grafts or pedicled flaps, according to the size, shape and location. W. B. Davis[45] notes that one should not persist in radiation therapy of basal cell carcinomas when they are not responding satisfactorily, but go ahead with excision and repair before there is too much surrounding fibrosis and depletion of blood supply. He often repairs the defect by an immediate full thickness skin graft, using distal flaps or prostheses only for the more extensive ones. Pickerill[143] illustrates the repair of defects resulting from the excision of malignant tumors by means of flaps and grafts and Weaver[185] shows some nice results from the repair of these defects.

UPPER EXTREMITIES.

Greeley[73] has noted that heavy keloided burn scars covering the dorsum of the hand can create almost total disability. Excision and replacement with thick split grafts may restore good function, giving a strong, soft, flexible covering. Kanthak[93] does about the same thing, cutting the graft with a dermatome and using a pattern so that he will not have any

excess graft left over. Converse[32] has found that the ordinary dermatome drum may not be large enough to permit the repair with one piece of graft, so that he has constructed an 8 x 6-inch drum to fit on over the dermatome. Pierce, Klabunde and Emerson[148] describe the uses of grafts and flaps in repairing hands. Lyle[109] reports a case of a mangle burn of the hand and forearm which was repaired with an abdominal flap, Thiersch grafts and two pinch grafting sessions, but the mixed repair gave a poor cosmetic result.

Shaw[164] notes that a direct, single pedicled flap from the abdominal wall can be used for a good many repairs about the forearm and hand. Peterson[142] has reconstructed a thumb in two patients by means of a tubed abdominal flap. A peg bone graft was later inserted through the flap, driving it into the metacarpal, and the resultant thumbs were useful for apposition as well as appearance.

LOWER EXTREMITIES.

The military hospitals have had a good many patients with extensive soft tissue losses of the lower leg and foot, with or without compound fractures or major nerves or tendons damaged beneath them. In some installations, this has been the most common type of injury cared for on the plastic service, often to prepare the patient for subsequent bone, nerve or tendon work. Wonderful results in rehabilitating these patients have been obtained, but very little has been written about the work. J. B. Brown and Cannon[22] have summarized their large experience with the repair of surface defects of the foot and most of their findings can be applied with equal value to repair of similar defects of the lower leg. Nine general methods of repair are considered: *1.* Excision and resuture is chiefly valuable in the treatment of very small lesions or in partial amputations. *2.* Free skin grafts are quite valuable when sufficient padding and blood supply are present. They can also be used as a temporary dressing to get raw areas healed and clear up any infection present. *3.* Direct local flaps are often useful in the repair of smaller areas, but there must be an adequate blood supply in the flap and in the neighborhood. They should not interrupt important sensory nerves. *4.* Delayed local flaps are safer and can

be used for the same repairs as direct local flaps with the same precautions. *5.* Direct cross leg flaps permit quick and good repairs in many instances when the recipient and donor areas can easily be brought into good apposition and still maintain enough pedicle for the flap. The opposite thigh is generally a better donor area than the lower leg, permitting larger repairs with more safety. *6.* Delayed cross leg flaps can be used for the same purpose, with the same precautions, and with more safety, though they consume more time. It is possible to use a narrower pedicle in some instances and they can be used either flat or tubed. *7.* Same-leg delayed flaps are occasionally used — usually tubed. They are especially useful when the opposite leg is missing. *8.* Distant jump or caterpillar flaps are rarely necessary and are more time consuming and accompanied by more failures than most other types of repair. *9.* Distant wrist-borne flaps are occasionally of some use, though in general are time consuming and wasteful.

Other papers on the repair of lower extremities are considered in the section on skin grafting.

BREASTS.

If the number of articles is any index, there has been an unusual amount of interest in this type of reconstructive surgery recently. Maliniac[111] has studied the blood supply of the breasts in detail and finds that the three main sources are from *a.* the internal mammary artery, *b.* the thoracic lateral artery, and *c.* the aortic intercostal arteries. The most frequent combination is from the internal mammary and the thoracic lateral. The thoracic lateral artery arises from the external mammary, which is a branch of the axillary. It is situated anteriorly to the perforating branch of the third intercostal nerve and rapidly abandons the posterior aspect of the pectoral muscle to enter the tail of the breast. He also describes three basic types of a deep periareolar plexus, a circular type occurring in 74 per cent, a loop type seen in 20 per cent, and a radial type present in the remaining 6 per cent for nutrition of the areola and nipple.

Thorek[180] reviews his 25 years' experience with breast reconstructions and prefers the Lotsch type of operation for

minor degrees of prolapsus and his own operation (with free transplantation of the nipples) for marked prolapsus or marked hypertrophy. Adams[1] does a one-stage operation with free transplantation of the nipples and areolae for extremely large and pendulous breasts. He excises the excess, reshapes the remainder, and then chooses the site to set the nipples in. He notes that the free transplants should include a small portion of the underlying smooth muscle so that the nipples will be elevated from the areolae. Lamont[101] does a modified Biesenberger operation usually, but takes out the excess in three wedges. He sometimes does a two-stage operation in which he performs a free transplantation of the nipples first and a modified Biesenberger operation later. Biddle[15] points out that the average normal position of the nipples is 4½ inches from the midline and opposite the third or fourth interspace. He often uses a sheet silver triangle, 9 inches on each side, with the apex at the suprasternal notch, to locate the new position before and during the operation. He does most of his under local nerve block and uses a special compass to make the incision around the areolae. He then makes a vertical incision down to the bottom of the breast and undermines all of the skin. The breast is held up and all of the fat is sliced off the surface. Sometimes a keystone-shaped bloc is taken out and the pedicle is shortened by folding over and suturing. Special clamps are used for the skin excision and the skin is closed in vertical lines.

A. M. Brown[19] has made latex prostheses to replace missing (amputated) breasts or to fit on over hypoplastic breasts. Berson[13] has used derma-fat-fascia transplants to build up the latter, obtaining them in one piece from the gluteal region. He thinks that the combined transplant absorbs less than plain fat and is less susceptible to infection.

LaRoe[106] has illustrated some of the bad results possible in this type of work, including asymmetrically placed and sloughing nipples, keloidal scars and misshapen breasts. He[107] has also used tissue removed from hypertrophied breasts to transplant into other individuals to fill in forehead defects, saddle noses, or to reconstruct amputated breasts. In one such latter case, there was a lot of bloody, fatty, purulent discharge beginning on the eighth day.

CARTILAGE TRANSPLANTATION.

Peer[140] dices autogenous cartilage into tiny pieces and finds that it is easier to use in filling many defects and yields better results. Connective tissue fills in the interstices, smoothing the whole area out and making additional bulk. This eliminates the need for any special carving and he has used it successfully in the repair of seven skull defects and in five ear reconstructions. In the latter,[139] he has placed the diced cartilage in perforated vitallium mold (at Aufricht's suggestion) and buried it subcutaneously in the abdominal wall. After a short time the particles form a single solid, adherent plaque which is ready to use in the reconstruction.

Young[195] has precast diced cartilage for ear reconstructions in a perforated ticonium mold which is buried subcutaneously in the abdominal wall. He has also molded ordinary diced cartilage implants into shape by a unique pressure dressing technique which he has called "casting." He makes negative *A* and positive *B* casts of the patient's face and builds up the restoration in modeling compound on the latter *B*. A new negative *C* is then made from the restored *B* and a new positive *D* cast made from *C*. This is a positive *D* of the patient's face as it is desired to be. About one-eighth to one-fourth inch of the modeling compound is layered evenly over *D* and a third negative *E* made. *E* is then put on *D*, the space between them filled with latex and vulcanized. This gives a thin rubber negative mold of the restored face. The defect in the patient's face is then filled with diced, autogenous cartilage, and the rubber mold is applied and bandaged tightly in place to hold the pieces of cartilage in the desired shape for the first week or two.

Nunn[134] describes a preserved cartilage bank which he operated in Vancouver Barracks in 1942, using merthiosaline and refrigeration as preservatives. Lamont[100-102] relates his findings in the late gross and microscopic examinations of necrocartilage.

LOCAL TREATMENT OF BURNS AND OTHER GRANULATING WOUNDS

The number of agents used on these wounds has been legion and as the reviewer has noted in the past, it is prob-

able that no single agent will ever replace gentleness, meticulous cleanliness and pressure in the care of these wounds. It is not possible to review all of the recent articles on this subject, but certain ones have been of interest to the reviewer.

Tannic acid was very nearly finished at the time of the last review, and it has lately been relegated to its place of historical interest. Since then, Hirshfeld, Pilling and Maun[84] have confirmed that it does produce extensive damage to surviving derma, and Forbes and Evans[59] have confirmed that it does produce liver necrosis. It is interesting and admirable that McClure, Lam and Romence,[121] of the Henry Ford Hospital (where its use originated) administered the last rites in an article entitled: "Tannic Acid and the Treatment of Burns: An Obsequy."

Baxter, Stevenson, Schenker and Browne[9] studied the effect of different agents on the rate of epithelial regeneration, using the dermatome donor area. Bettman's gauze (oxyquinoline sulfate, liquid paraffin, trichlorbutanol and scarlet red) was used as a standard and compared to 3 per cent xeroform, 10 per cent boric acid ointment, plasma plus Bettman's gauze, red cells plus Bettman's gauze, and testosterone plus Bettman's gauze. It was not found that any of these agents produced healing more rapidly than the standard. Miscall and Joyner[128] have experimented with the use of hemostatic globulin and plasma clot dressings and M. Marks[116] has used a substance known as "Castilian Malva," which is obtained from a weed and has a vasodilating action. Meyer and Gradman[127] have found that the sulfa spray has the disadvantages of other eschar-forming agents and that nonadherent pressure dressings require less nursing care, have less infection, are more comfortable and produce better healing.

Chlorophyll is so ubiquitous that many have tried to find some use for it in medicine. L. W. Smith and Livingston[170] have studied the effect of local applications of it in wound healing and thought that it accelerated healing in about 70 per cent of their cases by about 25 per cent in time. Vitamin B, C and D ointments had no demonstrable effect. Biodyne, methionine and Castilian malva wet dressings caused slight

acceleration in about one-third of the cases. Sulfa drugs caused retardation and Scharlach R ointment was essentially inert. One thousand three hundred seventy-two wounds were studied, with chlorophyll being used in 448.

Cannon [24] reports on the treatment of patients from the Cocoanut Grove disaster at Massachusetts General Hospital and notes that the immediate application of occlusive dressings without preliminary cleansing or debridement was not due to the overwhelming numbers of patients, but was deliberately planned in advance. It was thought better to get the wounds covered immediately rather than to wait for recovery from shock, and that scrubbing might increase the contamination of the wound surface. Douglas[51] describes local treatment by means of irrigation and pressure within a transparent jacket system. The jackets are made of a glass plastic cloth (krestex) and some are semirigid. They prevent contamination and the wounds can be aseptically irrigated at will. The jackets have also been used on extremities immediately after skin grafting, maintaining an air pressure equivalent to 30 to 45 cm. column of water. May[119] reviews the healing processes, various local treatments and methods available for covering deep burn losses.

Connor and Harvey[28] state that the thing that most often delays skin grafting of burns is getting rid of the slough. They found the slough separated more quickly at a low pH and after experimenting with various acid mixtures found a solution of pyruvic acid in a starch paste best to use. With it, they were able to get wounds ready to graft as early as 17 days on humans (10 days after starting the use of the pyruvic paste).

Lund and Browder[108] point out that the surface area of various segments of the body varies with age and they have compiled new tables for its estimation at various ages, which they believe to be more accurate than Berkow's method.

SKIN GRAFTING.

Sutton,[177] H. A. Lamont[104] and McIndoe[125] all point out the advantages of early grafting of raw areas and the latter notes that it is not necessary to have large wounds sterile.

McCorkle and Silvani[122] take their patients to the operating room during the second to third week, excise all necrotic tissue and graft immediately. Their burns varied from 2 per cent to 32 per cent of the body surface and the total hospitalization varied from five to 12 weeks with an average stay of 6½ weeks. Pritchard[164] does his first dressing on burns between the ninth and fourteenth day and on six patients biopsies were done at that time. If the frozen sections show it to be a full thickness burn, he removes all necrotic tissue and grafts immediately.

Marcks[115] explains further the use of the thickness determining apparatus which he has devised for attachment to a skin graft knife. G. V. Webster[187] states that "it is wrongly assumed that the average surgeon cannot cut a thick split graft by a free-hand technique." He prefers a handle which holds a large removable "sextoblade" razor blade. Schumacker[167] has devised a carrier to go on the dermatome which holds four Valet safety razor blades in line. Glasser and Richlin[67] prefer to scrape epithelial dust off the donor area with a razor or scalpel and transplant this material. The scrapings resemble bran flakes and they are mixed with a sterile solution of acacia to form a jelly and this is applied to the granulating wound with a tongue blade. By this technique, they were able to get a leg ulcer from the knee to the ankle healed in four operations and the patient resumed work six months after he was first treated. It is apparently not intended to transplant any dermal pad. Zintel[199] resplits split grafts by cutting them thick with the dermatome, leaving them on the drum, setting the knife blade to a thinner level, and then slicing through them again. He notes that the method may increase the yield from a limited donor area.

Sane,[157,158,159] from her work in the laboratory on tissue cultures developed a glue for skin graft fixation to avoid sewing or bandaging (snubbing) them on. The glue consists of heparinized plasma and an extract prepared beforehand from the patient's own blood cells. Sheehan[166] publishes one leg ulcer in which the graft was fixed by this method. Harris[82] used this method for fixation of homografts, except that he used stock plasma and stock cells instead of preparing the patient's own plasma and cells and thought that the results

were just as good. Jenney[89] has used commercial thrombin in place of the cell extract with equally good results. He also advocates using a layer of coarse mesh gauze (bobbinet) between the dermatome drum and the graft, this permitting easier removal of the graft from the drum, and the overlapped areas of the gauze are glued to the surrounding skin (around the recipient area) with rubber cement. If the recipient area is uneven, he puts a pressure dressing on over this, as he has noted that bleb formation is more common when pressure dressings are omitted. He has also devised a mirror attachment for the dermatome blade carrier so that the operator can see where he is cutting.

Tidrick and Warner[181] have tried fixing on grafts with plasma and thrombin and have obtained "takes" ranging from 68 per cent on chronic ulcers to 90 per cent on fresh surgical wounds. They immerse the grafts in stock plasma, flood the recipient bed with thrombin solution (1,000 units/cc.) and apply the grafts. A pressure dressing is usually applied over the grafts, though they are sometimes left exposed. Young and Favata[197] flush the recipient bed with stock plasma, then wet the under surface of the grafts with the thrombin solution (25 units/cc.) and apply the grafts. In their first article they stated that the grafts became so firmly fixed that sutures, splinting or retentive dressings were not necessary; however, in a later article, Young[196] stated, "It is our definite impression that the loss of grafts is considerably greater on infected wounds when applied by this method than when compression dressings are used. This applied to contaminated fresh wounds as well as to granulating beds. . . . It is also evident that the greatest loss is at points of movement—the fibrin strands . . . do not have great strength and can be rather easily broken by movement." He believes that the method can be used for: *1.* fresh surgical defects, *2.* to hold grafts on while applying pressure dressings, *3.* to hold postage stamp or pinch grafts in place. Cronkite, Lozner and Deaver[37] also noted that the method is useful for holding pinch or flagstone grafts in place. Roberts and Schaubel[152] prefer to snub grafts on with vaseline gauze, particularly dermatome grafts which are so sticky that they are more easily handled on a sheet of vaseline gauze.

J. P. Webster[188] has gotten around this problem of handling sticky grafts by cementing a sheet of pliofilm on the dermatome drum before cutting a graft. He can then peel the sheet of pliofilm off the drum easily with the graft attached to it, and apply it to the recipient area. The suturing is done through the film and graft and he finds it much easier than when the film is not used. The film has enabled him to cut thinner grafts and remove them from the drum without tearing them. At times, he has refrigerated[189] these grafts by folding the pliofilm with the graft on the inside, wrapping it in several layers of grease gauze and sterile towels, and keeping it in an ice box at 4° C. This has been done 36 times on 23 patients and all grafts stored up to three weeks have taken satisfactorily. The principal use of this procedure is to divide big operations on debilitated patients into stages. He has also experimented with quick freezing of grafts in a vacuum. Hardy and McNichol[81] have used Webster's pliofilm method for removal of grafts and have cut them up into postage stamp size. They feel that the small grafts are easier to handle when they are backed by the film.

Greeley[72] lists the advantages and disadvantages of pinch, Thiersch, thick, split, full thickness and pedicle grafts. He feels that one should think of free grafts first, especially split grafts, and then use others if there is some good reason for changing. Aufricht[4] contrasts pedicle flaps versus free skin grafts in the repair of contractures of the chin, cheeks and neck. He prefers tubed flaps for major defects as he thinks that they give a better esthetic result, do not shrink so much, are safer in regard to "full take," better covering for any bone or cartilage transplants, and are more suitable for later surgical remodeling.

Cannon[25] has reported the procedures used in rehabilitating the patients from the Cocoanut Grove fire who were admitted to Massachusetts General Hospital. Thirty-nine live patients were admitted, of whom nine had third degree burns extensive enough to require skin grafting. Seventeen grafting operations and one flap were done, the latter to cover exposed tendons on a hand. Split grafts were used for covering all other raw surfaces. Straatsma[173] has published some nice results obtained from split grafting raw burns,

with the repairs being obtained with a minimum amount of time and operating. Greeley[71] routinely uses split grafts to cover raw areas, cutting them free-hand, as he thinks it is faster and more simple when the lower extremities are available as donor sites. He uses the dermatome for obtaining grafts from the chest wall or a scaphoid abdomen. He has tried the original and modified applications of the coagulum-contact (Sano) technique, but has not had any greater success than with the well standardized procedures. It was noted that surface area was lost by this technique because grafts contract some by their own elasticity right while applying them, and it was noted repeatedly that a natural coagulum quickly forms between the graft and a raw area anyway. In another article, he[70] has reviewed the uses of Z-plastics, triple Z's grafts and flaps. McDowell and Brown[124] have pointed out that such procedures as the Z-plastic do not create any new tissue, but merely change the direction of the tension. Thus they are more applicable for the correction of loose webs (resulting from linear scars) than for areas where a large amount of skin has been lost. They also work better in older subjects with lax, wrinkled skin than in youngsters with tight, crowded skin. Oberdorfer[135] reports a case in which he did a primary skin graft for a small skin avulsion in the temporal region. Judd and Havens[92] report nine cases of traumatic avulsion of the skin of the penis and scrotum. They usually implanted the testicles in the thighs and covered the penis with a split graft held on with a sponge rubber donut and bandage. Whelan and Thompson[191] feel that skin grafting and secondary closure of war wounds have shortened the convalescence in many instances. Saltonstall and Lee[156] report two patients with massive deep burns, one of whom died.

Converse and Robb-Smith[29] have studied the healing of dermatome donor sites in 469 instances, obtaining 63 biopsies. They concluded that the quality of the healing was roughly proportional to its rapidity. The rapidity was dependent on: *a.* the thickness of the graft, *b.* the thickness of the skin of the donor area, *c.* the degree of looseness of the skin in the donor area (looser areas healed faster), and *d.* infection. They found an occasional small island of regenerating epi-

thelium around a sweat gland, but nearly all of the new epithelium came from hair follicles.

Sachs and Goldberg[154] have used foreskin isografts on burns and reported 65 per cent to 75 per cent take. They thought that they could recognize some of them eight months later. Schattner[160] interchanged full thickness skin grafts on identical twins and shows photographs of them two months later.

Lange[105] describes a new method for the immediate determination of the adequacy of circulation in ulcers, skin grafts and pedicle flaps. In the dark room, the area is viewed under ultraviolet light which is filtered through glass. Ten cc. 5 per cent fluorescein solution (to which has been added enough 5 per cent sodium bicarbonate to make it soluble) is injected intravenously. Within 15 to 20 seconds, all areas with a rapid circulation will turn an intense golden green. The first signs of direct capillary circulation into a transplanted flap were seen in 144 hours, and full vascularization was first present in eight days. Pinch grafts became vascularized in 96 hours. Dingwall and Lord[49] have used the same method in dogs and in patients and believe it is accurate for estimation of amount of blood flow through pedicles. Douglas and Buchholz[52] did extensive studies on the circulation in pedicle flaps, using blood pressure determinations in the pedicle, observing hair growth in flaps, and doing temperature-return experiments. They found that the blood pressures were low in tubed pedicles shortly after their formation, but returned to normal at about two weeks. Hair growth was retarded until three weeks. In tubed flaps still attached at both ends, the thermocouple "temperature-return" test indicated that the circulation had reached maximum efficiency in six to seven days.

Hirschfeld, Pilling, Buggs and Abbott[83] have reported on their use of penicillin in skin grafting. They gave 120,000 units intravenously daily. Before this regime, they had 25 per cent or more loss in one-third of their patients with granulating burns; afterwards they had 90 per cent to 100 per cent take in 17 patients and 80 per cent take in another one. The grafting was done three or four weeks after the burn in all but five patients. Mowlem[130] describes the preparation

of granulating areas for skin grafting on his service in England. Saline baths, 5 per cent trypsin and hypochlorite solutions are used in the early sloughing stages and pressure dressings later to get rid of any edema. The sulfa drugs are the chief agents used against infection.

Barbera[5] investigated the effect of experimental scurvy in guinea pigs on pedicle flaps. He found that pedicles could be severed in normal pigs in 15 to 20 days. In normal pigs which had no vitamin C after operation, extensive necrosis followed severance of the pedicle in 15 to 20 days. In pigs that were scorbutic before operation, the primary adhesion of the flap became less secure and eventually the pedicles mummified.

Hance, Brown, Byars and McDowell[40] report the improvement in appearance in skin grafts or flaps which can often be obtained by the intradermal injection of permanent pigments. Grafts or flaps from a distance usually do not contain the same red tones as facial skin and can be made to blend better with it by the pigment injection. The procedure is most helpful in grafts or flaps which are paler than the surrounding skin, or even dead white, but is not so good when they are darker. The process can also be used to touch irregularities in the vermilion or eyebrows, or even to create entirely a simulated vermilion.

PROSTHETIC FEATURES.

There has been more interest in this subject lately than at any time since the last World War. They are not recommended to replace surgical restoration, but are of temporary use in some patients while awaiting surgical restoration and can be used in others in which there is some contraindication to surgery such as extreme age or debility, advanced malignancy, etc. As a general plan, negative and positive casts are made of the patient's face, using plaster of paris for either one or both, or megacoll for the negative and hydrocoll for the positive. The restoration is built up on the positive cast with modeling clay, dental wax, modeling compound or some other material, and a new negative cast is made. The feature is cast between the new negative and the positive (with the clay, wax or modeling compound removed).

Materials used for the features include latex, acrylic and some of the newer elastic vinyl resins. Sweeny, Baxter and Copeman[178] prefer the vinyl resins, as do Gurdin, Bau and Kevan.[77] The former note that the resins come from the manufacturer in a variety of skin tones, but cannot be individually tinted. They are, however, soft and rubber-like in contrast to the acrylics which look and feel stony hard. Color can be applied to the surface, they are easy to handle, light, translucent, unaffected by ordinary heat and cold, and can be trimmed and repaired with a hot spatula. Gurdin[78] mentions that firm adhesion to the face is obtained by wetting the under side of the prosthesis with ethyl alcohol and sticking it on.

Gerrie[66] prefers latex at present because it is the most natural appearing material available. He notes the lack of durability and hopes to have something better to use later. Matthews[117] also prefers latex and supplies his patients with an average of three new prostheses every six to 12 months. Spirit gum is used to fasten the edges on the face.

Round[153] has developed a new method of fixation to the face. For the ear, he raised two small tubed flaps, one above and one below the external auditory meatus. Soft vulcanite hooks are fastened on the under side of the prosthesis and these are hooked over the tubed flaps. For the nose, he makes three small pockets lined with Thiersch grafts, one at the bridge and one on each side just inside the ala. He uses triangular projections on the base of the acrylic nose, the lower two being movable and connected with a fine spring.

Dietz[47] has reviewed all of the recent literature on prostheses and describes the considerations and techniques involved in detail.

MISCELLANEOUS.

Frantz[61] has reported on the use of absorbable cotton, paper and gauze for obtaining hemostasis, and Putnam[149] describes its use with thrombin in neurosurgery. Frantz, Clarke and Lettes[60] believe that it does as well without thrombin as with it. They also note that it is a foreign body in the tissues for several days and as small amounts as possible should be buried in closed wounds. It is felt that it is a

considerable help in securing hemostasis in certain instances, but that it is not a substitute for meticulous surgery.

Yudin[198] decribes his experiences in the surgical reconstruction of an artificial esophagus in 80 patients. He does a two-stage exteriorization of the jejunum, anastomosing it to the upper end of the esophagus in the neck. Occasionally a small skin tube is used to bridge the gap if the jejunum cannot be pulled high enough without jeopardizing its blood supply. Many different methods of esophagoplasty are reviewed in his article.

Cannady[23] has used the cutis graft for repairing defects in aponeuroses, replacing dura, replacing ligaments of the knee and other joints, reinforcing the walls of aneurysms, building out the surface contour of the face, stage ligation of blood vessels, autoplastic sutures and as support for the bowel in colostomies. He appends several case reports, including one ankylosis of the jaw in which he sectioned the ramus and put a folded strip of cutis graft between the ends. After two years, the function remains good.

Holman[86] is critical of recent writings advocating vertical neck incisions and points out the advantages and possibilities of horizontal ones. Barsky[7] describes the psychology of the patient undergoing plastic surgery, and Goldman[69] has devised an accessory operating table for oral surgery in infants and children. Fomon[58] believes that plastic surgery should be divided up amongst other specialties, or that the other specialties should be divided so that each would have a plastic subgroup such as a plastic ophthalmologist, plastic otolaryngologist, plastic orthopedist, etc. Goldberg[68] has used chlorophyll in the treatment of 300 cases of Vincent's stomatitis and pyorrhea and believes it to be quite helpful in various oral infections.

Peer[141] has written a review of plastic surgery for 1942, and McDowell[123] one for 1943.

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ETIOLOGY OF EXTERNAL OTITIS.*

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INTRODUCTION.

Patients with infections of the external auditory canal constitute a large part of routine ear, nose and throat practice both in and out of the armed forces. These cases, which may form from 5 to 20 per cent of out-patient practice, are often difficult and time consuming, even in the hands of a trained otologist. Little is known about the etiology or pathology of external otitis and as a result there are numerous therapeutic agents generally employed in treatment, many of which have little scientific basis for their use.

This is the first of a series of reports on an investigation of the etiology, pathology and treatment of external otitis. Since effective treatment first requires a knowledge of the etiology of the disease entity, this report will deal with available literature and data obtained in regard to the etiology of external otitis.

The specific objectives of this study are:

1. To determine if any single species of bacteria or group of bacteria can be found to be consistently associated with cases of external otitis.

2. To determine by cultural methods the frequency with which fungi are obtainable in a large unselected series of cases.

3. To determine the relationship between the severity of the disease and the bacterial and/or fungous flora.

4. To correlate the color and consistency of the discharge with the bacterial or fungous flora.

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REVIEW OF THE LITERATURE.

In the past, there has been considerable emphasis upon fungi as the etiological agent in external otitis. Fungi have been reported especially by physicians practicing in tropical and subtropical countries, where fungi are normally so widely prevalent. Isolated reports are available describing cultures of aspergilli obtained from the ear canal of patients in China,[1] India,[2] Hawaii[3] and Palestine;[4,5] monilia in Malta,[6] the Panama Canal Zone,[7] India;[8] mucor in Syria[9] and Hawaii.[3] In this country, similar fungi have been cultured from ear canals, principally in southern states.[10,11,12,13]

These fungi can be cultured readily from the general surroundings. Aspergilli are found particularly in any dusty environment. A lesser number of penicillia have been recorded, although this organism may be found on decaying organic matter such as cheese, bread or fruit. Mucor is frequently found on bread and is occasionally cultured from the ear. Monilia is often cultured from normal gastrointestinal tracts.

Filamentous fungi have been isolated from the normal skin by Downing, Nye and Cousins[14] in scrapings from behind the ears, the corners of the mouth and from between the toes. Monilia albicans, on the other hand, are not found in the flora of normal intact skin.[15,16]

Since fungi are particularly prevalent in warm, humid climates, it is not surprising that southern otologists have written most extensively about external otitis and have preferred to consider fungi as the causative agent in this disease. Thus, William D. Gill[17] writes: "Mycotic otitis externa is the type of external otitis most often seen in the south and southwest." Whalen,[7] McBurney and Searcy,[18] Minchew, Collins and Harris,[19] Reèh[20] and others have described excellent therapeutic results obtained with the use of cresatin and thymol, both of which are excellent fungicides. Chisolm and Sutton[21] and King Gill[21] made a plea for a more thorough search for fungi and suggested that fungous infections are more common than suspected. Dart[22] gave an excellent review of the literature and cited 23 cases of proven otomycosis.

In sharp disagreement with these authors are many mycol-

ogists and dermatologists and some otologists who believe that, with few exceptions, the fungi that are cultured from cases of external otitis are harmless saprophytes and rarely cause skin disease. They contend that the fungi occasionally found may have been present prior to infection, or were implanted into the fertile culture medium formed by the infected and macerated epithelium of the external auditory canal. It is held by this group that external otitis is primarily a bacterial disease.

A number of reports, now available, describe the procurance of bacterial cultures from the normal intact skin. In scrapings from behind the ears of 100 cases, Downing, Nye and Cousins[14] found staphylococcus albus in almost every case. Hexthausen[23] reported streptococci on the normal skin of seven out of 92 individuals. Friedman and Hinkel[24] reported a bacteriologic study of 25 normal ear canals showing a predominance of staphylococcus albus, diphtheroids and micrococci. Few streptococci and no bacillus pyocyaneus or other Gram negative bacilli were found.

A somewhat different bacterial flora is described when cultures are obtained from ears showing chronic inflammatory changes. Williams, Montgomery and Powell[25] reported on cultures obtained from 37 ears showing chronic external otitis. Micrococci were found in 10 (27 per cent) cases, streptococcus viridans in nine (24 per cent), staphylococcus aureus in nine (24 per cent), staphylococcus albus in eight (21 per cent), streptococcus hemolyticus in seven (19 per cent), a pseudomonas organism in four (11 per cent) and Gram negative bacilli in one (2.7 per cent) of their cases. They were unable on the basis of their bacteriologic findings to "establish definitely in any case that the dermatitis was primarily on a bacterial, fungal or allergic basis." Mitchell[26] emphasized the rôle played by streptococci in the production of chronic dermatoses of the ear. Friedman and Hinkel[24] were unable to give exact statistics on the cultures obtained from their 200 cases but they listed the following order of occurrence in their acute cases: staphylococcus aureus, staphylococcus albus, diphtheroids, bacillus pyocyaneus and micrococci. Only eight cases of aspergilli were reported. No predominant organism was present in their chronic cases.

Until recently, very little clinical importance has been attributed to the Gram negative bacilli which are grouped under the generic designation of pseudomonas. The majority of these organisms, referred to in the clinical literature as bacillus pyocyaneus, are generally considered harmless soil and water inhabitants.[27,28] Lately, however, these organisms have been identified as more than secondary contaminants and are considered the possible etiologic agent in certain diseases. Bacillus pyocyaneus has been found in cases of meningitis,[29] septicemia,[30] dysentery,[31] and has been isolated in pure cultures from corneal ulcers.[32,33,34,35,36] Ledderhose[37] and Charrin[38] showed that the injection of cultures of bacillus pyocyaneus into experimental animals resulted in abscess formation and general septicemia. Intravenous inoculations of sterile cultures of the pyocyaneus organisms into rabbits produced diarrhea, albuminuria, paralysis and death.[38]

It would seem, then, from the literature, that the pseudomonas group of organisms has the potentiality of producing severe infections both in experimental animals and humans, and that the toxins produced by the organisms will cause inflammatory changes in tissue.

Despite these observations, little attention has been given to the frequent reports of cultures of pseudomonas organisms from cases of external otitis. Repeatedly, careful observers have described the presence of these organisms among their cases but have disposed of them as unimportant secondary invaders. Thus, Greaves[39] found the pyocyaneus organisms in every one of his 75 cases. Dunlap[1] reported that all of his cases in China showed the pyocyaneus organism. Davis[40] reported 22 patients who showed "secondary infection with bacillus pyocyaneus." Morley,[41] in Aden, described eight out of 13 cases yielding bacillus pyocyaneus. Daggett,[6] in Malta, reported bacteriologic findings in 49 cases in which 16 showed bacillus pyocyaneus, while another 19 showed an organism that was listed as bacillus proteus.

Because of the emphasis placed upon fungi as the etiologic agent in external otitis, investigation has been directed toward the development of fungicidal rather than bactericidal agents and toward the more efficient treatment of fungous disease. Insufficient consideration has been given to the

possibility that the largest percentage of infected cases were solely of bacterial origin.

Further confusion has arisen in the literature from the failure of the dermatologists and otologists to draw a clear distinction between the acute and chronic forms of external otitis. It is fully appreciated that any attempt at classification of cases is difficult and that the various grades of this disease merge into one another; yet, if etiology and therapy are to be evaluated, some idea of the type of case treated must be presented. Our cases were divided according to the following classification:

External Otitis

1. Acute			83 ears
a. Circumscribed		=	(1 ear)
b. Desquamative	(Mild 42 ears) (Moderate 33 ears) (Severe 7 ears)	=	(82 ears)
2. Chronic			53 ears
a. Suppurative (Otomycosis)		=	(7 ears)
b. Eczematoid (Neurodermatitis) (Eczema)		=	(46 ears)

Acute external otitis includes all those cases with a history of recent onset of pain, tenderness, etc. The acute ears are divided into those showing circumscribed and desquamative involvement. Since only one ear in this series of cases showed *circumscribed* external otitis, this type of infection will be discussed in a later report. The *desquamative* external otitis group is composed of those acute ears which showed widespread involvement of the squamous epithelium of the canal.

All cases of acute desquamative external otitis were subdivided into three groups, as follows: The *mild* case complains of a tenderness on touch or manipulation of the auricle, a feeling of blockage of the ear, and shows some adherent desquamated epithelial debris on the wall of the ear canal. *Moderate* cases include those having pain on movement of the auricle, some edema and cheesy desquamated material over the canal wall and slight periauricular adenopathy. The *severe* external otitis case presents systemic symptoms, severe pain on movement of the mandible. On examination, periauricular adenopathy, cellulitis, and a very reddened and

edematous canal wall coated with serous or cheesy debris are found.

The *chronic* external otitis category embraces all patients who describe a prolonged history of external ear complaints. This type of subject has usually been treated by many doctors and has tried many proprietary medications with only short periods of relief from his symptoms. Because the chronic cases, on examination, present a marked divergence in their findings, they are subdivided into two groups: *1.* suppurative, and *2.* eczematoid.

The term chronic *suppurative* external otitis refers to those cases which show a heavy gray or green discharge which, when removed, reveals a thickened discolored epithelium coated with a thin desquamative white exudate. Chronic *eczematoid* external otitis includes the many varieties of itching, weeping, vesicular and dry crusted conditions which have been at various times called eczema, allergic external otitis or neurodermatitis. In this latter group are placed the cases of true *otomycosis*, since these patients complain mainly of itching, a feeling of fullness in the ear canal and occasionally some difficulty in hearing.

MATERIALS AND METHODS.

During nine months of 1944, patients were referred by the Station Hospital, Randolph Field, Tex., to the AAF School of Aviation Medicine for consultation and treatment. All patients were accepted for study and treatment regardless of prior therapy. Every subject was directed to write a description of previous ear infections and an account of his present otologic symptoms. Each ear was examined by the writer and, on the basis of history and otologic findings, the infection was designated according to the above classifications as acute mild desquamative, chronic suppurative, etc.

In order to gain some knowledge of the flora of normal ear canals of men stationed on this field, bacterial and fungus cultures were obtained at random from 33 men (66 ears) who had no ear complaints and who had volunteered as experimental subjects. Thus, bacteriologic and mycologic data were obtained on 123 subjects (234 ears) which include:

Type of Involvement	Number Subjects	Ears Involved	Ears Uninvolved
Bilateral	45	90	—
Unilateral	45	45	33*
Normal	33	—	66
Total	123	135	99

*This total of 33 ears was occasioned by the elimination from this study of 12 uninvolved ears because of incomplete bacteriologic data.

An attempt was made to obtain cultures routinely on both ears of all patients, whether or not both ears appeared to be infected. Initial cultures were taken directly by means of sterile applicators onto blood agar† plates prepared from Bacto blood agar base to which 5 per cent defibrinated human blood was added. At the same time cultures from both ears were taken by means of sterile applicators and planted onto Bacto Sabouraud's dextrose agar slants for fungus growth. When "typical" fungus exudate was observed, direct smears were obtained and a search made for mycelial threads.

The blood agar plates were incubated at 37° C. and were routinely examined after 24 hours, 48 hours or after a longer period when necessary. Colonies were then picked, smeared and stained by Gram's method. When indicated, cultures were inoculated into further differential media, or tested for motility by hanging drop slides.

The Sabouraud slants were kept for three weeks and examined each day for evidence of fungus growth. The fungi were identified by microscopic examination (wet preparation). Cultures of blood agar plates possessing the characteristic fruity odor and green color of the pseudomonas group were smeared and stained. If Gram negative rods were found, further identification for purposes of this study was considered unnecessary. In the case of Gram negative rods without characteristic odor and color, the suspicious colonies were inoculated into Bacto Loeffler's blood serum media to test for proteolysis, into lactose broth (1 per cent lactose in veal infusion media) to test for lactose fermentation, and into veal infusion broth and nutrient agar to test for pig-

†All culture media used for bacteriological procedures in this study were prepared from dehydrated culture media made by Difco Laboratories, Inc., Detroit, Mich.

ment production. Hanging drop slides were used to test for motility.

When uncertainty existed concerning the identification of Gram positive cocci from blood plates, the colonies were fished to veal infusion broth and examined microscopically after 24 and 48 hours' incubation. Depending on pigment, morphology, size, division, etc., these were reported accordingly as staphylococcus albus or aureus, or micrococci. (Since it was not possible to observe staphylococci longer than 48 hours, cognizance is taken of the fact that many of the organisms listed as staphylococcus albus may have in time developed pigment and thus would have been listed as staphylococcus aureus.)

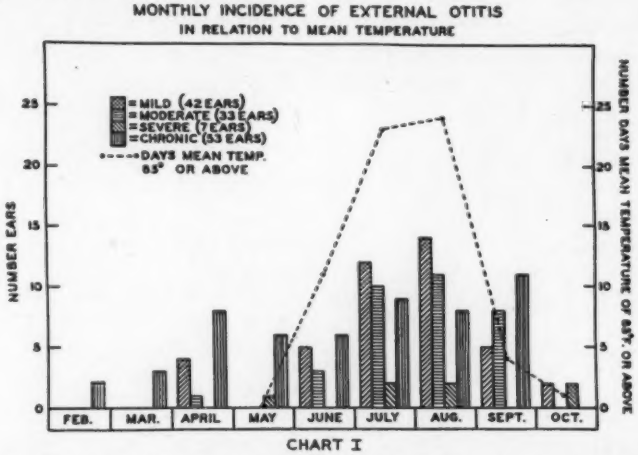

CHART I

In the event it was impossible to identify micro-organisms by the use of the above-mentioned methods and differential media, the organisms were reported simply as other Gram positive cocci, other Gram negative rods, etc.

When cultures were taken on patients who gave a history of treatment with sulfonamides, blood agar plates containing p-aminobenzoic acid, 10 mg./100 cc. media, were used.

RESULTS.

In agreement with reports in the literature, Chart 1 reveals that at Randolph Field, Tex., *acute* external otitis

TABLE 1. DISTRIBUTION OF ORGANISMS CULTURED FROM 82 EARS SHOWING ACUTE DIFFUSE EXTERNAL OTITIS.

	Severe (7 Ears)		Moderate (33 Ears)		Mild (42 Ears)		Total (82 Ears)	
	No.	%	No.	%	No.	%	No.	%
GRAM NEGATIVE BACILLI								
Pseudomonas	7	100.0	21	63.6	16	38.1	44	53.7
Proteus	–	—	—	—	1	2.4	1	1.2
Others	–	—	10	30.3	14	33.3	24	29.3
GRAM NEGATIVE COCCI								
Diplococcus	–	—	2	6.1	1	2.4	3	3.7
GRAM POSITIVE BACILLI								
Diphtheroids	–	—	1	3.0	2	4.8	3	3.7
Others	–	—	1	3.0	4	9.5	5	6.0
GRAM POSITIVE COCCI								
Staphylococcus albus, hemolytic	–	—	—	—	1	2.4	1	1.2
albus, nonhemolytic	2	28.6	4	12.2	13	31.0	19	23.2
aureus, hemolytic	–	—	2	6.1	5	11.9	7	8.5
aureus, nonhemolytic	–	—	—	—	6	14.3	6	7.3
citreus, nonhemolytic	–	—	—	—	1	2.4	1	1.2
Streptococcus, hemolytic	–	—	—	—	2	4.8	2	2.4
Streptococcus, nonhemolytic	2	28.6	2	6.1	1	2.4	5	6.1
Sarcina	–	—	1	3.0	2	4.8	3	3.7
Micrococcus tetragenus	–	—	1	3.0	1	2.4	2	2.4
Others	–	—	—	—	2	4.8	2	2.4
FUNGI								
Aspergillus	–	—	2	6.1	3	7.1	5	6.1
Others	–	—	1	3.0	3	7.1	4	4.9

occurred infrequently during the cold months and rapidly increased in incidence during the hot summer months when the greatest amount of bathing and swimming took place. A large percentage, but not all of the subjects presenting acute symptoms, gave a history of having been swimming just prior to the onset of the infection. It is seen that the incidence of acute desquamative external otitis increased rapidly from June through July and August and then gradually subsided in September and October. The *chronic* cases also appeared in larger numbers during the summer months, but it is obvious that this type of case constitutes a year-round problem.

Table 1 lists the distribution of organisms cultured from all the cases of acute external otitis. It is seen that from each one of the seven ears listed as *severe* desquamative, an organism of the pseudomonas group was obtained. It is particularly interesting that this was either the only organism or the

predominant organism in every one of the severe ears. Staphylococci and streptococci each occurred in two ears.

Approximately 64 per cent of the 33 ears included in the group listed as having *moderate* signs and symptoms showed pseudomonas organisms while 30 per cent showed other Gram negative organisms. Although many other organisms were found, none occurred frequently enough to warrant further mention.

TABLE 2. DISTRIBUTION OF ORGANISMS CULTURED FROM THE EARS OF 33 NORMAL SUBJECTS AND FROM UNINVOLVED EARS IN 33 CASES OF UNILATERAL EXTERNAL OTITIS.

	NORMAL (66 Ears)		"Uninvolved" (33 Ears)	
	No.	%	No.	%
GRAM NEGATIVE BACILLI				
Pseudomonas	—	—	3	9.1
Others	4	6.1	8	24.2
GRAM NEGATIVE COCCI				
Diplococcus	—	—	2	6.1
GRAM POSITIVE BACILLI				
Diphtheroids	16	24.2	10	30.3
Others	—	—	4	12.2
GRAM POSITIVE COCCI				
Staphylococcus				
albus, hemolytic	7	10.6	2	6.1
albus, nonhemolytic	53	80.3	26	68.8
aureus, hemolytic	—	—	2	6.1
aureus, nonhemolytic	9	13.6	6	12.2
citreus, hemolytic	4	6.1	—	—
citreus, nonhemolytic	10	15.2	2	6.1
Streptococcus, nonhemolytic	3	4.5	3	9.1
Sarcina	—	—	1	3.0
Micrococcus tetragenus	13	19.7	—	—
Others	—	—	1	3.0
FUNGI				
Aspergillus	2	3.0	—	—
Others	—	—	2	6.1

In the *mild* category which included 42 ears, typical members of the pseudomonas group were cultured from 38 per cent of the ears while other Gram negative organisms were obtained from 33 per cent of the cases. A much more diverse group of organisms were found here than were present in the moderate and severe categories.

When the figures for the mild, moderate and severe types of acute desquamative external otitis are totaled (82 ears), it is seen that pyocyaneous-like organisms were cultured in

54 per cent and other Gram negative bacilli in 29 per cent of the ears, while approximately 11 per cent of these ears showed fungi on culture. These findings are in sharp contrast to the group of normal ears (see Table 2) where 6 per cent of the ears cultured revealed Gram negative bacilli and not one of these organisms showed characteristics resembling the bacillus pyocyaneus. Fungi were found in 3 per cent of normal ears. The number of diphtheroids and micrococci found among the normals was quite high and practically every ear showed staphylococci.

TABLE 3. DISTRIBUTION OF ORGANISMS CULTURED FROM 53 EARS SHOWING CHRONIC EXTERNAL OTITIS.

	Suppurative (7 Ears)		Eczematoid (46 Ears)		Total (53 Ears)	
	No.	%	No.	%	No.	%
GRAM NEGATIVE BACILLI						
Pseudomonas	7	100.0	8	17.4	15	28.3
Others	–	——	9	19.6	9	17.0
GRAM POSITIVE BACILLI						
Diphtheroids	–	——	11	24.0	11	20.8
Others	2	2.8	3	6.5	5	9.4
GRAM POSITIVE COCCI						
Staphylococcus						
albus, hemolytic	–	——	6	13.0	6	11.3
albus, nonhemolytic	–	——	18	39.1	18	34.0
aureus, hemolytic	–	——	9	19.6	9	17.0
aureus, nonhemolytic	1	1.4	10	21.7	11	20.8
Streptococcus, nonhemolytic	–	——	7	15.2	7	13.2
Others	–	——	2	4.3	2	3.8
FUNGI						
Aspergillus	1	1.4	4	8.7	5	9.4
Others	–	——	1	2.2	1	1.9

Among those cases which were seen with unilateral infection, the "uninvolved" ear was also cultured in 33 instances in an effort to obtain data on the flora of the "uninfected" ear canal. Among the latter it is seen (see Table 2) that in three (9 per cent) of the uninvolved ears typical bacillus pyocyaneous-like organisms were demonstrated, while eight (24 per cent) of these ears showed Gram negative bacilli. Just as in the normal group, a high percentage of staphylococci and diphtheroids occurred, while a small number of fungi were found.

It may be significant that the close correlation between severity of clinical findings and bacterial flora did not occur with any except the Gram negative group of bacilli. Hemolytic and nonhemolytic staphylococus albus, staphylococcus

aureus and nonhemolytic streptococci occurred as often, if not more often, in the normal and uninvolved ears as in the infected ears. Hemolytic streptococci and bacillus proteus occurred very rarely in either normal or infected ears. Micrococcus tetragenus occurred more often among the normal ears than among the infected ones.

In the cases classified under chronic external otitis, there are seven *suppurative* ears, every one of which showed the pyocyaneus organism (see Table 3). On the other hand, the pyocyaneus-like organism was found in only eight (17 per cent) of the 46 *eczematoid* ears. A higher percentage of hemolytic staphylococcoccus aureus, nonhemolytic streptococci, pseudomonas and other Gram negative bacilli occurred in the chronic ezcematoid group than in the normal ears. In regard to the frequent references to diphtheroids as a possible cause of external otitis, it is interesting that the normal and chronic eczematoid cases showed almost identical percentages of diphtheroids (24 per cent) while the chronic suppurative and all grades of the acute desquamative ears showed very small percentages of diphtheroids.

When the data were analyzed to determine if a single strain of bacteria or combination of bacteria might be responsible for external ear infections, no combination of bacteria occurred frequently enough to be considered seriously. It was found that over one-half of the 82 acute desquamative ears and more than two-thirds of the chronic suppurative ears showed a single strain of bacteria on culture. This was particularly true where Gram negative bacilli were obtained.

Among the 46 chronic eczematoid ears the situation was somewhat different. Very rarely was only a single strain of bacteria obtained. Staphylococci occurred in practically every case and, with but few exceptions, were associated with streptococci diphtheroids, Gram negative bacilli or fungi.

An attempt was made in this work to correlate the appearance and color of the discharge with the organisms obtained on culture. Contrary to the widespread teaching, the so-called "blotting paper" type of discharge is not pathognomonic of a fungous infection. On direct smear of this exudate, myri-

ads of epithelial cells and organisms were seen, while on culture a pyocyaneous or staphylococcus was found most frequently. The black spotted sooty debris is readily and quite accurately diagnosed as aspergillus niger, the spores of the green-colored aspergillus fumigatus may be seen projecting from a large wax mass filling the lumen, and the white mucor corymbifer may be observed as a fine powdery or cottony fuzz anywhere along the canal wall.

On the other hand, the bacterial infection may produce almost any type of discharge from a thin serous to a thick grayish purulent secretion. Again contrary to popular teaching, there was no typical exudate observed in ear canals from which bacillus pyocyaneus was cultured. Often the characteristic green-colored seropurulent secretion was found, but a flourishing growth of bacillus pyocyaneus could be obtained in many cases in which the discharge was described as "wet blotting paper," "cheesy," "green mucoid," "yellowish putty," "clay-like," or "thick, gray purulent."

It is recognized that the bacillus pyocyaneus has the potentiality of overgrowing any bacteria or fungi which may have been present in the ear canal, and also that the bacillus pyocyaneus will overgrow other organisms on a blood agar plate; therefore, occasional direct smears of the exudate from the ear canal were examined with the purpose of seeking microscopic evidence of bacteria and fungi. Routine direct smears were not performed, and, therefore, no estimation of the other bacteria present can be offered.

In order to investigate the possibility that the bacillus pyocyaneus may have overgrown any fungi that existed at the onset of infection, Petri dishes containing special media were inoculated with bacillus pyocyaneus and various fungi recovered from infected ear canals. It was repeatedly demonstrated (with allowance for the type of fungus and media used) that the fungi are able to survive in the presence of pyocyaneus organisms. If one-half of the Petri dish were streaked with mucor corymbifer and the other half with bacillus pyocyaneus, strict demarcation would occur without growth of fungi on the bacterial culture; however, when the same experiment was repeated with aspergillus fumigatus or aspergillus niger, spores secondarily implanted on the bac-

terial half of the plate would germinate and sporulate. If pasteurized or autoclaved cerumen was added to the media and then fungi and bacteria inoculated, only slight inhibition of bacterial and fungous growth occurred.

DISCUSSION.

There is sufficient proof in the literature and in the observations made in this series of cases to demonstrate that acute external otitis is a bacterial disease and that in a large number of cases, the organism to be dealt with is a Gram negative bacillus which, in a very high per cent of cases, resembles the bacillus pyocyaneus (pseudomonas aeruginosa).

One explanation for the large percentage of Gram negative bacilli obtained on cultures of infected ear canals is the tendency for these organisms to overgrow anything else on the blood agar plate. The same cultural conditions may be present in the infected ear canal where the wet exudate within the canal is made up of epithelial cells, cerumen and transudate which also makes an excellent nutrient environment for growth of the Gram negative bacilli. As a consequence, other bacterial growth is inhibited and the therapeutic problem is one of eliminating the infection due to the Gram negative organisms.

It is believed that this series of cases offers proof that fungi play little part in the inception and persistence of *acute* external otitis. On the other hand, it is recognized that fungi do occur in a very small percentage of the *acute desquamative* and *chronic eczematoid* cases; and in cases where fungi are demonstrated, part of the treatment should be directed toward eradication of the fungi from the ear canal.

Only a knowledge of the bacterial and fungous flora of the external auditory canal will make it possible to treat these patients intelligently without frequent therapeutic failures. Almost any treatment one may devise will be successful against a mild external otitis from which staphylococcus aureus and diphtheroids have been cultured. The same therapy directed against a virulent pyocyaneus or aspergillus niger infection may result in temporary alleviation of symptoms, but the disease will recur within a period of weeks or months.

Since there is no single chemotherapeutic agent available at the present time which has been shown to be both an effective bactericide and fungicide for use in acute infections of the ear canal, it is important to recognize the necessity for careful examination and observation of all cases of external otitis. Wherever possible, bacterial and fungus cultures should be obtained. In the field where laboratory facilities are not always available, microscopic examination of wet preparations and direct smears stained with Gram's stain or methylene blue will enable the physician to establish the predominating organisms in a large percentage of cases.

Until it is possible to demonstrate that certain organisms (such as the pseudomonas group) or a combination of organisms is responsible for the clinical and pathological picture seen in various forms of external otitis, it is unlikely that clinical data alone will be sufficient to prove conclusively the etiology of this disease. Efforts are now being made to establish this infection in experimental animals.

CONCLUSIONS AND RECOMMENDATIONS.

a. Bacteriological and mycological data were obtained from 66 normal, 33 "uninvolved" and 135 infected ear canals at Randolph Field, Tex.

b. These data obtained from this series of cases demonstrate that external otitis at this station is primarily a bacterial disease.

c. Fungi played little part in the inception or persistence of external otitis seen at this station.

d. Gram negative bacilli (especially the pseudomonas group) were found in a high percentage of ears showing acute desquamative and chronic suppurative external otitis.

e. A review of the available literature suggests that a similar distribution of organisms exists in cases of external otitis occurring in other tropical and subtropical areas.

ADDENDUM.

Since making this report, attention has been directed to a similar study performed in New Guinea by Maj. A. F. Quayle[42]

which confirms, to a large extent, the observations made at Randolph Field, Tex. Pseudomonas (pyocyaneus) organisms were found in 65 per cent of the infected cases and were not found among normal ears. Unilateral infected cases showed pyocyaneus organisms in the involved ear and not in the uninvolved ear. Fungi were found rarely.

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MUCOCELE OF THE NASAL ACCESSORY SINUSES.*

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Stedman in his medical dictionary defined a mucocele simply as a cyst containing mucus. McKenzie[1] wrote, "The modern opinion is that a mucocele is a mucus cyst (and in turn a form of adenoma) which, undergoing active enlargement, leads to a distention of the bony walls of the sinus and their slow atrophy."

Although mucocele of the nasal accessory sinuses was not dealt with as a problem in therapeutics in authoritative medical literature earlier than the eighteenth century, this pathologic condition must have existed in ancient times. An interesting bit of writing indicating this is the description by Boenninghaus[2] of a skull discovered by him among the thousands ornately arranged on the walls of the famous chapel at Tscherbeney, which was built entirely of human bones. Boenninghaus made a careful examination of this skull. He found the bone structure large and strong, with the teeth for the most part absent; the skull appeared to be that of a person of middle age. The cranial capsule was perfectly preserved. A large part of the anterior wall of the frontal sinus was absent. In the cerebral wall of the left frontal sinus was a roundish defect, approximately 1 cm. in diameter. From these and other observations, Boenninghaus concluded that the person had suffered from mucocele of the frontal sinus.

The first physician to collect records of mucocele of the accessory sinuses was the French pathologist, Berthon.[3] In 1880, he published his essay in which he recorded cases of other physicians. Some of the most interesting and valuable outlines of cases in Berthon's review are taken from a report of Dezeimeris, published in 1839. The earliest of these case reports outlined by Dezeimeris is that of Henry Albert Nico-

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lai, which appeared in a medical journal published in Strassburg, France, in 1725. The case report is interesting as a historical contribution to the therapeutics of mucocele. The patient was a soldier who suffered from extremely painful headaches. No physician seemed able to find a remedy. These headaches had begun three years previously, at which time the soldier had suffered a fracture of the skull from a sword cut. The treatment prescribed was "powder, emulsion and external remedies." The second day after beginning treatment, the patient felt an "explosion" in his head. This was followed by a thick purulent nasal discharge, streaked with blood, which lasted for a day and resulted in complete cessation of pain.

A second early case report of interest is that of Johannes Ludwig Welge,[4] published in his dissertation, "De Morbis Sinuum Frontalium" in 1786. He described a case of "suppuration in the frontal sinus," with considerable dilatation of this cavity, occasioning, by pressure exerted on the skull, a comatose state, and considerable tumefaction of the visage. The condition resulted from "old venereal disease." During the patient's hospitalization, a splinter of bone was removed from the orbital cavity and the ethmoid sinus. Mercuric chloride, followed by Plummer's powder, was administered, "with mercurial unctions around the eye." The frontal and maxillary sinuses and the nasal fossae were found to be merged into a single cavity. The patient refused further treatment and left the hospital.

The case of Prof. Langenbeck,[5] reported in 1818, is considered by some authorities to be the first authoritative report of a case of mucocele of the frontal sinus. At any rate, Warlomont[6] considered it of sufficient importance to be included in the translation of his textbook.

Other early case reports are of interest particularly from the historical point of view.[7] A perusal of these, all cited by Berthon,[3] will give the reader a good idea of the handling of mucocele of the accessory sinuses by physicians up to the latter part of the nineteenth century. In the twentieth century, medical practice has advanced by leaps and bounds far beyond the early and often crude concept. Nevertheless, all that is known and all that is done today is based, step by step,

on the foundation laid by those hard working, poorly equipped, but patient and determined, pioneers in the art of healing.

ETIOLOGY.

The etiology of mucocele has been attributed to trauma, upper respiratory infections and to childhood diseases by Gaus,[8] Megret,[9] Briani,[10] Kuhnt,[11] Geschelin,[12] Dabney,[13] Berger,[14] Ferreri[15] and others.

SIGNS AND SYMPTOMS.

The most common sign of mucocele is a rounded, painless, smooth swelling in the roof or inner wall of the orbit which cannot be compressed, making its appearance just above the inner canthus. The swelling may involve the entire upper lid or the forehead or most of the nose. On the other hand, a mucocele of the lower ethmoid region may extend downward into the nose, appearing at times as a large middle turbinate. As a rule, the patient complains of ocular and nasal disturbances, and headaches. Less common signs are proptosis, a sluggish pupil reaction, congestion of the conjunctiva, epiphora, diplopia due to limitation of mobility, and edema. More rarely found are myopia, strabismus, dermatitis, anisocoria, photophobia, astigmatism, ulceration of the cornea, glaucoma, optic neuritis, vitreous opacities and cataractous changes of the lens. Strange to say, in a few cases (usually those in which the lesion is far advanced) involvement of the eyes has not been evident.

A mucocele is sterile unless a secondary infection occurs, it is not encapsulated nor will it become malignant.

On examination, neither inflammatory changes nor tenderness are noted over the swelling. Crepitus may be present when the bone becomes thin and cracks. After absorption of the bone has taken place, the edges of the bone may be felt. The eyeball may be displaced outward, downward and forward, yet the changes are wrought so slowly that diplopia rarely occurs. On palpation the mass may feel soft and elastic, or it may fluctuate. The appearance of the nares is usually not suggestive, and no secretion is noted.

Turner[16] has made the important observation that new bone may be laid down close to the areas of erosion so as to give the impression of the formation of an osteoma.

DIFFERENTIAL DIAGNOSIS.

The following lesions at times simulate mucocele and should be considered in attempting to make a diagnosis: Meningocele, dermoid cyst, osteoma, fibrosarcoma, sebaceous cyst, tumors of the lacrimal sac and phantom tumors of scar tissue.

Chamberlain and Parry[17] stated that aspiration may be used as an additional diagnostic aid, but it is seldom necessary.

Tremble[18] has outlined a method of injecting iodinized oil into a mucocele, after aspirating its contents, to be followed by an X-ray examination.

TREATMENT.

The treatment is not only surgical but, comparative speaking, also requires radical surgery.

I dislike the use of the word radical as used above as it frequently gives the wrong impression, but in this case no other word could show the complete surgery which is so essential. Certainly there is no minor surgery of the nose when as, in my experience, a patient dies from meningitis following a clean removal of the anterior tip of the middle turbinate.

A few years ago a case of supposedly chronic pyogenic infection of the antrum and ethmoid revealed the importance of an accurate diagnosis as to the type of sinus involvement. In this case, despite the use of all methods known by the essayist, including a Roentgenological examination for making a diagnosis, only a part of the true picture was known prior to the operation.

After having completed the radical antrum operation, the ethmoids were opened by the transantral approach and a mucocele involving the ethmoid and frontal sinuses was found. A large portion of the mucocele's wall was removed;

however, eight months later an external frontoethmoidal procedure was required.

After reading practically all of the articles on mucoceles, one can definitely state that most modern authors agree that merely incising or cutting away a portion of the wall of the mucocele is totally inaedquate for a permanent cure. Having tried it once, as stated above, and with the failure that resulted, I am completely convinced of the verity of this statement.

The doctrine that the entire wall of the mucocele should be removed, in addition to providing ample drainage when possible, should always be remembered. Less than this, in most instances, will necessitate further and more difficult surgery.

Many do not feel that mucoceles occur in either the antrum or sphenoid. Heatly[19] states that, "Mucocele of the sphenoid is extremely rare; in fact its occurrence is disputed by many. Cases, however, have been reported by such careful observers as Hajek and Berber." Fornari[20] reported, in 1937, that he had found only nine reported cases of mucocele of the sphenoid.

When one studies these articles it is evident that the correct diagnosis might have been mucocele of the ethmoid.

Chamberlain and Parry[17] stated, "So-called mucocele of the antrum of Highmore in the cases so far reported contain only a thin serous fluid and not the thick gelatinous and tenacious fluid which is characteristic of mucocele of the frontal sinuses and ethmoid sinus." These cysts are usually of dental origin.

Lopes,[21] in 1937, found that only 15 cases of mucocele of the maxillary sinus had been reported in the literature. De Paula Assis,[22] in 1942, stated that "there had been only 17 cases of mucocele of the maxillary sinus reported in the literature."

Whether you agree as to the possibility of mucoceles of the antrum or sphenoid, it is evident that if they occur they are

extremely rare; therefore, the description of their treatment will be omitted.

Despite my interest in anatomy, I find that the details are difficult to remember; therefore, it is not amiss to discuss a few anatomical facts, if one is to perform the required surgery safely.

ANATOMY.

The anatomy of the frontal sinus is best understood by studying a bit of embryology. This is particularly true since the location, size and shape of both the frontal sinus and the nasofrontal duct depends upon the location of the cell which extends upward, forming this anatomical entity. The development embryonically originates usually from the recessus frontalis or the infundibulus ethmoidalis or both. (The cell or cells push upward, forward and backward through the soft cancellous portion of the frontal bone, carrying with it as its lining the mucous membrane of the nose.) The most frequent point of origin is the recessus frontalis. Most authorities believe that the frontal sinus reaches its maturity prior to or at puberty.

The nasofrontal duct may be continuous with an anterior ethmoid cell through the unciform groove lying between the unciform process and the ethmoidal bulla. If the nasofrontal duct parallels this groove, it is usually pushed outward as it passes around an ethmoid cell. This is the nasofrontal duct that is most easily occluded. The frontal sinus that extends backward, toward the sella, usually drains through a duct in the area of the posterior cells of the anterior ethmoids. You can see from this elementary discussion of the location of the nasofrontal duct that it varies in size, shape and location. It may be irregular, crooked, partially occluded at one point and wide at another. Certainly it is not always constant in size with a large lumen of such shape that its secretions can easily drain therefrom. Simply and from a surgical standpoint, it can best be remembered by realizing that the contour of the nasofrontal duct depends on how it is pushed about in its embryonic development by the ethmoidal labyrinth. This fact is most significant.

There is no reason to discuss the relations of the frontal sinus here; however, in a study of many anatomical specimens, only two were found wherein the posterior ethmoid group of cells was in contact with the floor of the frontal sinus.

The ethmoidal labyrinth is pyramidal in shape. The base of the pyramid is located posteriorly, and the upper portion is wider than the inferior. The thin wall of bone surrounding the ethmoidal labyrinth is incomplete in three areas. The anterior wall of the sphenoid completes the box posteriorly. The lacrimal bone completes the box anteriorly and superiorly, while superiorly and medially the frontal bone supplies another wall. The incompleteness of this bony covering in part explains the extension of certain infections or growth by continuity of tissue from the ethmoid to the frontal or sphenoid or vice versa.

If one of the anterior cells lies adjacent to the frontal sinus and also to the nasofrontal duct, surgical drainage of the frontal through the duct is more easily accomplished. Another important relation we should all remember is that frequently a large posterior cell lies in close proximity to the orbit and optic nerve. The outline of the optic nerve, covered only by a very thin layer of bone, may be seen in some specimens.

For practical purposes the blood supply of the frontal and ethmoid sinuses is the sphenopalatine artery, a branch of the internal maxillary springing from the external carotid artery, the ophthalmic branch of the internal carotid artery, and possibly from the following vessels of the dura over the superior and lateral surfaces, and from the Haversian systems. In evaluating the possible complications and their prevention, bear in mind these vascular pathways.

SURGERY.

The surgical approach is by means of an external frontoethmoidal operation. The external operations basically are divided into two procedures, one of which opens into the frontal sinus through the anterior wall and the other through the floor. The first group of operations may be divided into

those which enlarge the nasofrontal duct, both with and without skin grafting, and those in which the duct is not disturbed. When the duct is not molested, it has been advocated that 2 or 3 mm. of mucous membrane of the frontal sinus be left around the upper opening of the nasofrontal duct. The Killian type of operations may be again divided into those in which the ethmoid cells are removed either partially, or completely, or left untouched as much as possible, and those which obliterate the sinus cavity by leaving the wound open with dressings being changed as needed, and the space allowed to granulate from below upward. Matis,[23] in 1939, reported a subperiosteal approach to avoid any external scarring. This unusual method, though interesting, is in general neither practical nor necessary for the avoidance of noticeable scarring.

The fact that so many similar procedures have been evolved from the same basic operation means only one thing: none of the operations is satisfactory.

If we recall the description given of the nasofrontal duct it is easy to understand why these operations fail in so many cases. There is no method known whereby the nasofrontal duct can routinely be kept patent following any of these operations.

The external approach through the floor of the frontal and the orbital wall of the ethmoid was developed by Lynch,[24] though it had been in part conceived by Jansen[25] and Knapp.[26] Some minor improvements in technique have been developed, but basically it continues to be the Lynch operation. Strangely enough it was slowly accepted, despite the fact that it is comparatively easy, safe, adequate drainage is established, and is followed by little cosmetic deformity; therefore, the Lynch[24] operation is not only the operation of choice in mucocele of the frontal and ethmoidal region but also in pyogenic infections when an external operation is indicated.

INDICATIONS.

1. When conservative treatment and intranasal surgery fail to accomplish the desired result.

2. When there is pus retention or chronic infection with

a serous discharge, particularly in large sinuses with many ramifications. Pus in itself is no indication of the virulence of an infection, but rather indicates the amount of cellular resistance.

3. Extracranial complications, subperiosteal abscess and fistula formation.

4. Intracranial complications.

5. Mucocele.

6. Certain other tumors.

LYNCH OPERATION.

The middle turbinate should be removed well in advance of the Lynch operation, particularly if the posterior ethmoids and the sphenoid are to be treated surgically. Oral sepsis is a necessary adjunct. I prefer a general anesthesia. After preparing the patient, the nasal cavity is cleaned and your favorite germicide is applied intranasally. The eyebrow is neither clipped nor shaved but should be carefuly cleansed. A postnasal plug is used. The lids of the eye are drawn together with adhesive and protected by fluff gauze.

The incision begins at a point on the nose below the lacrimal sac and is carried upward and outward through the middle of the brow. The length of the horizontal portion of the incision should be governed by the size and shape of the sinus as determined by X-ray examination. Cross-cuts help in approximation when closing the wound.

It is easier to begin the elevation of the periosteum near the lower end of the incision and work upward until the lower flap is freed from the operative field, being careful of the lacrimal sac. Sutures should be used to retract this flap. The tissue above the incision should not be disturbed. The anatomical landmarks and limitations can best be followed by first opening the frontal, then the ethmoids and sphenoid.

The floor of the frontal sinus is removed, obliterating the angle formed by the floor and the posterior wall. In this regard, special attention should be given to the outer angle. The lining membrane is completely removed with the aid of

curettes. Then, to quote Lynch,[24] "With the removal of the nasal process of the superior maxilla, the lower lateral edge of the nasal bone, the lacrimal and the entire lamina papyracea of the ethmoid, there results a complete evisceration of the entire ethmoidal labyrinth, since the middle turbinate has been previously removed, and particular search is made for those orbital and sinus extensions of the ethmoid." Carefully retract the orbital contents and remember that the optic nerve has only 7 mm. of play.

The remaining cells and the sphenoid can be handled under direct vision both through the wound and the nose itself.

A large, soft, three-eighths to five-eighths-inch rubber drainage tube beveled at the upper end is placed through the nose into the lower portion of the frontal sinus. It is unnecessary to discuss packing, closure or postoperative care, but I would like to remind you that your sutures should not penetrate the periosteum of the upper flap.

The technique varies in relation to the sinuses involved, but the anterior ethmoids should always be removed, as that is an integral part of this frontal operation.

CASE REPORT.

The case report to be presented has been previously published by the essayist. It presented many characteristics of an ordinary mucocele with the unusual feature of exposed cerebrum. The report will be concise, yet the detail must be such that the continuity may be easily followed.

A white male of 36 years, whose family and past history were of no clinical interest, stated that for three days he had had a mild constant headache over the left eye. Shortly before he was seen, the headache ceased and he noticed blurring of vision in his left eye. He had had attacks of sinusitis for three years.

Both eyes were essentially negative on examination. Vision, O. D. 20/13; O.S. 20/25. The right eye remained normal throughout the illness. Four days after the examination, the vision of O. S. was 5/200. The fundus was totally obscure as the vitreous was filled with small, rapidly moving vitreous opacities.

The general physical and dental examination and blood work were negative.

The nasal examination was essentially negative.

Roentgen examination revealed that the right frontal sinus was large

and slightly cloudy. The left frontal sinus was very large and slightly cloudy. Just above the left orbit was an area of decreased density, which was attributed to the possible destruction of bone. In the trabecula between the right and the left frontal sinus was a fair-sized osteoma. The left anterior ethmoid cells were slightly cloudy, and the right anterior ethmoid cells very cloudy. Both right and left maxillary sinuses were moderately cloudy. The sphenoid area was cloudy, and the sella turcica was normal.

An immediate Lynch frontal operation, ethmoidectomy and sphenoidectomy was advised.

With the patient under general anesthesia, the left frontal sinus was opened. The ethmoid labyrinth was disturbed as little as possible, as we preferred removing the infection of the frontal sinus before attacking the ethmoid or the sphenoid sinuses. After removal of the floor, the lining of the frontal sinus appeared slightly thickened with the exception of an area about the size of a nickel adjacent to and around the nasofrontal duct. Here the mucous membrane was considerably thickened. It was not edematous, nor did it show signs of infection but appeared to be merely a thickened but otherwise normal mucous membrane.

The mucous membrane lining of the frontal sinus was stripped off and removed in the usual way. No undue effort was required. With the exception of the inner plate, the uncovered bone was normal in all details. No evidence of an osteoma was found. The inner plate was markedly eroded, and two large sequestrated pieces of bone were removed. This removal left little or none of the inner wall intact.

A portion of the dura approximately 1.5 cm. in diameter was necrotic. This was removed, exposing the brain substance. The cerebrum thus exposed showed no signs of infection, either acute or chronic. The vessels were not congested, no edema was noted and not even the slightest degree of herniation of the brain occurred. No cerebral spinal fluid was lost. As would be expected, the dura was firmly attached to the brain substance around the exposed areas. The remaining dura was normal in contour and appearance, with no visible signs of infection. Preoperative findings indicated infection of the left anterior group of ethmoid cells, and surgical intervention proved this condition to be present.

If the ethmoid cells were disturbed further, what was the possibility that the infection would be scattered to such an extent that the dura or the brain substance would become infected? If, on the other hand, the infected ethmoid cells were not removed, would it in any way minimize the possibility of success? The latter course, in spite of its dangers, was chosen. Had the ethmoid cells been exenterated, a large patent opening would have connected the frontal sinus with the left naris. My associates and I were opposed to this despite the fact that some authorities state that the upper nasal passages are sterile.

But for the possibility of pus pockets developing, the external bony wall of the frontal sinus might have been removed, forcing the soft parts against the defect in the inner plate. The result of the contact of infected material with the dura or the brain substance was also feared.

When the wound was closed, a large drain was inserted from the outside into the sinus at the inner angle. Skin clips were used to draw the margins of the skin together.

Pathologic Findings: Macroscopically, the tissue removed from the inner plate had the appearance of sequestrated bone; however, the pathologist stated that the specimens removed were really thickened mucous membrane. Histological examination of the wall of the mucocele revealed

that it was composed of several layers of densely packed epithelium. Some areas were composed of connective tissue. The inner layer of epithelium was poorly preserved. The mucous contents contained a few degenerated epithelial cells. No cholesterol in crystals was found. No evidence of infection was noted.

PROGRESSIVE NOTES.

Fifty-one days following the operation, the drainage tube was removed and the healing process within the frontal sinus was observed by using a nasopharyngoscope. The walls were covered with healthy granulation tissue, and no evidence of infection was noted. The anterior ethmoid cells were removed, gauze packing was used, and the external wound was closed.

The patient's vision was normal and all of the intraocular pathology had disappeared.

The patient had monocular vision in the mornings, when he was rested. Later in the day, diplopia was very noticeable, making it impossible for him to read without covering one eye. With prismatic correction of the hyperphoria, he was quite comfortable.

At this time the patient, during a casual conversation, recalled that seven months prior to his first operation he had been awakened in the night by a discharge from his left nostril, so profuse that it had saturated several handkerchiefs. This, together with the other findings, proved conclusively the diagnosis of mucocele. It also explained why the frontal sinus had appeared practically normal, with the exception of thickened mucous membrane, when it was opened, and why no fluid was present.

At the end of two and a half years the muscular imbalance had entirely disappeared. The fundi were normal. After 12 years the patient's general health is excellent, and there has been no recurrence of the mucocele. No muscular imbalance or vitreous opacities are now present, and his vision is normal in each eye.

CONCLUSIONS.

Ocular complications in the reported case occurred seven months after the mucocele had spontaneously ruptured and drained.

One phase of the etiology of the changes that occur, though seldom, in the posterior half of the globe, resulting in impairment of vision, should be discussed.

Several years ago a very prominent ophthalmologist stoutly maintained that the loss of vision as defined above was never due to sinusitis. The case just reported would not substantiate his thesis. The loss of vision in cases of sinusitis evidently is not due to an extension of the infection or toxemia, but rather to circulatory disturbances occasioned by pressure. There can be no doubt as to the cause of the loss of vision in the reported case, with the rapidity of its development and termination.

The rupture of the mucocele evidently was adequate, as no secretions were noted intranasally prior to the operation, nor was any fluid found within the frontal sinus at the time of the operation. Here again is a case of mucocele with adequate drainage which required the removal of the wall of the mucocele to effect a cure.

The extreme thickening of the lining membrane around the upper end of the nasofrontal duct has intrigued me. This observation has not been noted by another writer so far as I know. Could the etiology in this case be explained by the thickening of the mucous membrane of the nasofrontal duct and adjacent areas of the frontal sinus, due to an ethmoiditis, followed by the occlusion of the nasofrontal duct with no infection of the frontal sinus? Would it be rational to assume that this and other similar conditions are the causative factors in mucoceles of all of the sinuses?

For clarity, we can expostulate that the etiology of a mucocele of an accessory sinus is secondary to an infection or an irritation, which occludes the ostium of an adjacent noninfected sinus by the thickening of the mucous membrane within the duct or ostium, to the extent that the normal drainage from within the sinus is completely blocked. It is by direct extension that more than one sinus is involved.

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FALL REFRESHER COURSE IN LARYNGOLOGY, RHINOLOGY AND OTOLOGY AT UNIVERSITY OF ILLINOIS COLLEGE OF MEDICINE.

The University of Illinois College of Medicine announces its sixth semiannual Refresher Course in Laryngology, Rhinology and Otology, Sept. 24 through Sept. 29, 1945, at the College, in Chicago. The course is intensive and largely didactic, but some clinical instruction is also provided.

It is especially suited to specialists unable to devote a longer period for advanced instruction and to others seeking a comprehensive review of the field of otorhinolaryngology. The number of registrants will be limited. It is, therefore, desirable to apply for registration immediately. The fee is $50. When applying, give full details as to school and year of graduation, postgraduate training, college degrees, etc. Write to Dr. A. R. Hollender, Chairman, Refresher Course Committee, Department of Otolaryngology, University of Illinois College of Medicine, 1853 West Polk Street, Chicago 12, Ill.

DIVERTICULUM OF THE ESOPHAGUS — OPERATION.*

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Definition of Esophageal Diverticula: A sac that projects from the wall of the esophagus, involving some or all of the wall and small portions of the circumference.

Historical Account: Ludlow,[1] in 1764, and Bell,[2] in 1816 mentioned "preternatural pockets" in the esophagus and a "preternatural bag" formed by the "membrane of the pharynx."

Classification and Sites of Esophageal Diverticula: Traction or true diverticula are made up of all the coats of the esophagus. They extend laterally due to the contraction of scar tissue from neighborhood inflammation, as bronchial lymph nodes, and occur usually in the middle two-thirds of the esophagus. They are found often on the anterior wall, tent-shaped and small in size. Due to the lateral or upward position in relation to the longitudinal esophagus and the fact that the wall of the sac includes the muscular coat, spontaneous emptying is the rule, resulting in few symptoms. Should retention occur, which it seldom does, dilatation would be indicated. Surgical procedure is rarely necessary, and fortunately so, as it is difficult to accomplish in this area.

Pulsion or False Diverticula: Pulsion or false diverticula are most often acquired, a few being congenital. These form sacs extending in the lateral or downward position with retention of food contents. They occur most often at the pharyngoesophageal portion of the esophagus; second, in the midthoracic region; and least frequently, in the supradiaphragmatic portion.

A combination of the two varieties, traction-pulsion diver-

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ticulum, is described;[3] it is supposed to begin as traction and later takes on the features of pulsion diverticulum.

Epiphrenal, supradiaphragmatic or deep pulsion diverticula are often associated with cardiospasm. More are found on the right side than the left; and more are found to come from the anterior than the posterior part of the esophagus.

Diverticula due to stricture of the esophagus may occur at any level, and are not considered in this paper.

Pharyngoesophageal diverticula are rather pharyngeal than esophageal anatomically and occur more often on the left than on the right side. I know of no explanation for this.

THEORIES OF CAUSES.

1. Kulenkampff[4] regarded the condition analogous to inguinal hernia, the production of the sac favored by a weak point in the musculature.

2. Bell[5] mentioned distention of the pharynx from ineffectual attempts to swallow, with protrusion of the inner coats of the pharynx through bundles of the inferior constrictor pharyngeus muscle.

3. Moynihan[6] describes slit-like defects in the lower posterior pharyngeal wall where branches of the recurrent nerve and inferior thyroid artery vein and lymphatics penetrate.

4. Most authors agree that the sac arises at a weak area on the posterior wall of the pharynx between the oblique fibres of the inferior constrictor and the lower, more horizontal fibres of the constrictor, forming the cricopharyngeus muscle.

5. Observations point to frequent spasm of the cricopharyngeus muscle. Jackson[7] has noted this to bar passage of the esophagoscope. Spasm of this muscle has been known to cause recurrence of diverticula. Jackson dilates the muscle before operation to prevent recurrence.

6. Prolonged or abnormal spasm of the cricopharyngeus muscle results in prolonged retention of food in the hypopharynx, and increased pressure of deglutition could cause

beginning of a sac through the muscular weakness of the inferior constrictor.

7. Neuromuscular dysfunction and associated cardiospasm at the lower end of the esophagus may be etiological factors in this region.

8. There may be a constitutional basis, as diverticulum of the esophagus, duodenum and colon are often found in the same individual.

Symptoms: The variety and intensity of the symptoms of esophageal diverticula are in proportion to the size of the sac. Difficulty in swallowing, regurgitation of food, gurgling and splashing in the neck, due to air and fluid within the sac, are common symptoms. Regurgitation of food during the night, disturbing sleep, is a common complaint. A particle of food may be caught in the sac: this causes a tickling sensation and coughing as increased mucus is produced.

Regurgitation of sac contents is produced by pressure of neck muscles on swallowing. Patients often empty sac by pressure on neck with hand. The sac may be washed out by drinking water, and then squeezing the sac with fingers, by pressure on neck. Food may be retained in sac, decompose and cause breath odor.

More unusual symptoms are: stenosis of esophagus from pressure of sac, dyspnea from pressure on trachea; hoarseness from pressure on recurrent laryngeal nerve; Horner's syndrome from pressure on sympathetic; bronchitis, pneumonia, lung abscess from aspiration of sac contents.

Diagnosis: Diagnosis is made from symptoms and X-ray. The passage of sounds is dangerous and usually unnecessary. Esophagoscopy is a valuable aid.

Treatment: Treatment is operative, either in one or two stages, with complete extirpation of the sac. Up to 1915, the mortality was high with one-stage procedures.

In 1909, Goldman[8] performed a two-stage operation. The pouch was freed, the pedicle ligated with silk; the wound was packed, and the sac fixed to the surface of wound; the diver-

ticulum sloughed and a fistula formed which took months to heal.

In 1917, Hill[9] did a diverticulopexy with good results.

Girard,[10] in 1896, and Bevan,[11] in 1917, treated this condition by invagination and inversion of sac wall.

Kocher,[12] in 1892, and Niehaus,[13] in 1884, performed successful extirpation of the sac.

Murphy,[14] in 1916, implanted the sac in the wound, the neck unligated, and resected the sac two weeks later.

In 1933, Lahey,[15] in patients with small sacs, dissected the sac free, and sutured the tip to the sternohyoid muscle at a level higher than its neck within the wound. In a large diverticulum the sac was implanted within the wound pointing upward. This prevented the food from entering the sac between operation stages and resulted in early healing of fistula following second stage when the sac was extirpated.

When to Operate: When the sac is small and a simple pouch with no neck, there are usually no symptoms, and surgery at the early stage is neither indicated nor satisfactory.

When the sac is older and larger with a definite neck, it should be extirpated by either a one- or two-stage operative procedure.

When the sac is very large and by its weight pushes into the mediastinum, angulating the esophagus at this point, the patient should be fed by a Levine tube introduced into the stomach through the nose; or better, through dome of the sac, after it has been dissected free, brought up and fastened high in the neck wound. If possible, diverticulum of the esophagus should not be permitted to become so large.

Choice of One- or Two-Stage Procedure: In the one-stage procedure, danger of mediastinitis is present from possible spilling of sac contents during extirpation.

In the two-stage procedure the sac is dissected free, brought upward into wound, fastened to neck muscles, and neck closed with drain to mediastinum, so that at the second stage, 10 days later, when the sac is freed and extirpated, the possible spilling of sac contents will not get to mediastinal spaces.

Mortality in mediastinitis is high and for this reason the two-stage procedure should carry the lower mortality.

Choice of Anesthetic: In a one-stage operation or in the first part of a two-stage procedure, local infiltration or block novocain should be used. The patient retains his throat reflexes, which prevents aspiration of possible sac contents with resulting lung complications. Also, the patient may swallow and this may aid in identifying and dissecting the sac.

In the second part of a two-stage procedure, general intratracheal gas oxygen ether or cyclopropane may be used, as here the sac has no contents due to its high fixed position, and as local anesthesia is difficult to accomplish in infiltrated tissues.

Operative Procedure: Operative procedure is somewhat according to Lahey's technique and is as follows:

1. A long longitudinal incision, 1 inch medial to anterior border of sternomastoid muscle (transverse incisions do not give adequate exposure), and carried down through deep cervical fascia.

2. The sternomastoid muscle is retracted laterally, exposing the omohyoid muscle, which is severed, the ends being pushed aside in the direction of their insertions.

3. The thyroid gland is bluntly separated from the carotid sheath (containing the common carotid artery, the internal jugular vein and the vagus nerve). The gland is retracted toward the midline.

4. The inferior thyroid artery, which often lies just anterior to the sac, is divided between ligatures, bearing in mind its relation to the recurrent laryngeal nerve.

5. On elevating the lobe of the thyroid gland, the esophagus is seen with the diverticulum closely adherent by the fibres of the cricopharyngeus muscles. By a little blunt dissection a line of cleavage can be found, and the sac gently brought out of its bed, and separated from the longitudinal esophagus. The sac is grasped with blunt forceps, and careful dissection is necessary to free the neck of the sac from the

sling-like muscle of the inferior constrictor, so that the inferior acute angle of the neck to the esophagus may be converted to an obtuse angle. Especially at this point laterally, posteriorly and to the opposite side, must the neck of the sac be freed; otherwise, recurrence of the diverticulum may occur.

6. At this point in a one-stage operation, the sac is amputated through the neck, there being a proper amount of neck left for closure so as not to encroach upon the esophagus and cause stricture. Extreme care must be taken to avoid spilling of contents of sac or esophagus. Gauze pads should cover the area, especially in the lower angles of the wound toward the mediastinum.

7. With the sac amputated, the wound is closed in layers with a drain in the lower angle.

8. In the two-stage operation, the free sac is fixed high in the wound to the sternohyoid muscle with two black silk sutures that go through only the adventitial coat of the sac, as going through the sac wall might result in leakage. The ends of the silk sutures are left long so as to later identify the position of the sac in the second stage of the procedure. The sac must be fixed high so as to allow drainage and prevent the re-entrance of food. Care must be taken not to pull the sac too far up as to angulate the esophagus and cause obstruction.

9. The wound is then closed as in a one-stage procedure, with cigarette drain in lower angle, to be removed in four days. The drain, encouraging adhesions, seals the mediastinal spaces and so lessens danger of infection during the second stage procedure.

10. Patients are allowed up at end of first day, and feeding is instituted immediately. As the sac is hung high, food passes by the sac down the esophagus into stomach.

11. At end of eight days under intratracheal gas, oxygen or cyclopropane anesthesia, the wound is reopened, and by blunt dissection the sac is identified and freed from surrounding adhesions. The wall of sac will be found to be thickened due to edema. The sac is grasped with forceps and the distal

third is transversely excised. The mucous membrane is easily separated from the submucosa down to neck of sac. The mucosa is ligated with two silk ligatures, much the same as in a hernial sac, and the redundant portion excised. The submucosal sheath is allowed to extend upward, and the gauze of a cigarette drain is lightly placed in the sheath and the wound closed in layers. The drain is removed in three days, allowing the submucous canal to collapse. This collapsed canal pointing upwards prevents possible subsequent drainage of food through wound and sinus formations.

The supradiaphragmatic esophageal diverticulum — a pulsion type with sac and distinct neck — is discussed by Lahey and treated by suspending the sac high and fixing it to the parietal pleura, the method described by Hill[9]; thus food passes by through the esophagus and cannot enter the sac.

COMPLICATIONS.

1. Large implanted sacs, especially when they protrude from skin, may become distended with air, resulting in gangrene from pressure. This must be watched and relieved by placing a catheter in dome of sac to relieve the pressure.

2. Injury to recurrent laryngeal nerve.

3. Formation of a food sinus. These are due to a formation of a shelf from incomplete dissection of neck of sac. These sinuses all close spontaneously.

4. Accidental perforation of sac or esophagus. Should this occur, with leakage, the rent must be closed, preferably with silk, and the facial planes leading to the mediastinum filled with gauze packs. A Levine tube should be placed for feeding.

5. Angulation and thereby esophageal obstruction caused by too much traction as it is fastened to strap muscles.

6. Recurrences: probably due to incomplete dissection of neck of sac with shelf formations. In 1940, Lahey[16] reported three recurrences in 118 cases.

7. Stricture from extreme scarring and spasm of cricopharyngeus muscle may require dilation postoperatively.

8. Accidental hemorrhage from inferior thyroid artery.

9. Injury to internal jugular vein and superior sympathetic ganglion, the latter followed by Horner's syndrome.

Case 1:[17] Mrs. M. S., admitted to the William Booth Memorial Hospital, Sept. 30, 1929; aged 50, married and a housewife. Regurgitation of food and difficulty in swallowing for previous six months, increasing in severity, with saliva running from mouth on lying down. Slight pain at times just to left of trachea. Pressure just to left brings up food into mouth, and causes a gurgling sound.

Past History: Operations: Floating kidney, ectopic pregnancy, appendectomy.

X-ray: Diverticulum of esophagus.

Physical Examination: Overweight, short neck; pressure in region of trachea causes gurgling sound.

Operation according to the Goldman[8] method, Oct. 1, 1929: Ethylene ether anesthesia. A 6-inch incision along border of sternomastoid muscle; omohyoid was severed. Thyroid gland retracted medially and esophagus explored. Diverticulum, 3-inch by 2-inch, easily identified and dissected free of adhesions, and pulled up into wound. Neck ligated with silk close to esophagus, suture passed through wall of fundus and attached to skin. Sac surrounded with rubber dam and two cigarette drains placed on either side. Wound closed in layers. Dressed each day. There was a serosanguineous discharge. Sac separated on eleventh day, postoperatively. Two days later, ligature of stump was discharged through wound, with some food leakage. Two days subsequent to this, patient was discharged from hospital, with small sinus and some food leakage. The sinus discharged at intervals for a period of two months and then healed.

Patient remained free of symptoms for about eight months, when she began to complain again: difficulty in swallowing, choking during meals and regurgitation of food and drink. X-ray revealed recurrence of the diverticulum. Patient was readmitted to hospital on Oct. 25, 1931, 25 months following the first operation.

On Oct. 26, 1931, the patient was reoperated. There were moderate adhesions, but no difficulty in locating sac which had no real neck. The esophagus seemed merely to be ballooned out over a 3-inch longitudinal area. The diverticulum was made smaller by multiple reefing or plicating the wall of this ballooned out area, according to the Girard Bevan method. The wound was closed with a drain. The patient was followed for a period of three years, during which time she remained free of symptoms.

Case 2: Dr. W. N., dentist, aged 56, was seen first in 1942, complaining of difficulty in swallowing, a slight cough because of repeated accumulations of mucus in throat, and regurgitation of both fluid and solid food. By swallowing water and pressing near trachea on left side of neck, he was able to regurgitate the water and relieve the obstruction. There were no other signs or symptoms.

A diagnosis of esophageal diverticulum was made, and this was confirmed by X-ray.

On Aug. 12, 1943, a first-stage Lahey procedure was carried out, except that a drain was omitted. A diverticulum of esophagus, 3½-inch by 2-inch, was found low in neck lying close to esophagus. The neck of sac was one-half-inch in diameter, and it joined the esophagus. The wound healed by primary union. Twenty-one days later, a second-stage operation was accomplished, according to Lahey technique. The diverticulum

was removed without difficulty, and wound was closed with a drain which was removed in four days. The wound healed by primary union, and the patient has had no complaints since operation.

He was last seen in January, 1944, three months following the second-stage Lahey procedure, when he stated that he was entirely relieved of his previous symptoms. X-ray at that time shows a small amount of barium retention at side of repair of diverticulum.

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CAVERNOUS SINUS THROMBOSIS WITH RECOVERY. REPORT OF CASE.*

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Introduction: The author feels that, preliminary to reporting a case of recovery from a thrombosed cavernous sinus, it is not amiss to review the anatomy of these sinuses.

Prior to the advent of the sulfa drugs and penicillin, cavernous sinus thrombosis was about 90 per cent fatal and it is to this fact that I felt, in having a patient that has fully recovered, I should like to report same:

The cavernous sinus is placed on the side of the body of the sphenoid bone and contains the cavernous venous sinus, which transmits the IIIrd, IVth, VIth nerve, ophthalmic division of the Vth nerve, the internal carotid artery, and the carotid plexus of the sympathetic. There are numerous interlacing fibres running from the inner to the outer sinus wall. From these, the sinus derives its name — cavernous. Emptying into the sinus anteriorly is the ophthalmic vein and, posteriorly, it empties into the petrosal sinuses. During its course, it receives tributaries from the cerebral veins.

R. O., age 15. After returning from a hike on the evening of July 20, 1943, patient was thoroughly soaked by a storm which had suddenly come up. The following morning he noticed his left eye was swollen. He was treated by the camp physician until July 25 when Dr. Victor G. Bourke, of Livingston Manor, N. Y., was consulted. He immediately sent the patient into the Maimonides Hospital at Liberty, N. Y.

In answer to my request for the previous history of this case while under the latter's care, I received a letter from Dr. Bourke, dated Nov. 13, from which I quote:

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"Dear Dr. Herzig:

"Concerning the very interesting case of R. O., whose recovery from cavernous sinus thrombosis is especially rare, especially if you had seen it in the beginning, when I saw it first,—I must confess that I did not think it was possible for any patient to present such a degree of protrusion as this patient did. When he left the hospital here, his exophthalmos had gone down at least two-thirds, and the three-fourths of an inch that you described when you saw him impressed me as being almost trivial compared to that which was present when he first presented himself. When he came to the office, the exophthalmos was so pronounced that the eye fairly bulged through the palpebral fissure. I immediately transferred him to the hospital and put him on sulfadiazine. The charts attached will show that his response was phenomenal, and, as you will note, his temperature was normal for five days prior to his leaving the hospital."

The temperature chart as of July 25 was 101.8° upon admission, pulse 90, respiration 24. Under the administration of sulfadiazine the temperature gradually returned to normal by the first of August. Boric acid compresses as well as an ice cap had been applied to the proptosed eye. The patient received an original dose of 2 gm. sulfadiazine and 1 gm. q. 4. h. until Aug. 2 when the drug was discontinued. No spinal or blood cultures were taken.

On Aug. 3 a consultation was had with Dr. Walter Irving Neller, of Middletown, N. Y. I am quoting from the latter's communication as of Aug. 26:

"My examination of his eye on Aug. 3 was essentially the same as yours, although I was not sure as to whether this would be a definite cavernous sinus thrombosis, or whether it might be due secondarily to acute sinusitis, as this boy had been doing more or less swimming.

"I advised his father, who had gotten in touch with me by telephone, that the sooner the boy was removed to a hospital in New York the better.

"I am very glad to hear that he is doing well, as I have not been as fortunate with these cases of cavernous sinus throm-

bosis here on my service at the Horton Memorial Hospital."

On Aug. 3, the patient was admitted to the Fifth Avenue Hospital, care of Dr. J. A. W. Hetrick, who was kind enough to refer the patient to me. I saw the patient first on Aug. 4.

Temperature 101.4°. The eye was proptosed forward and downward about three-fourths inch. There was a complete motor oculi paralysis except for the sympathetic fibres to the iris which reacted to light and accommodation. The IVth and VIth cranial nerves showed a slight action. Enormous edema of the upper lid was present. Examination of the left fundus showed a tortuous engorgement of the veins with marked congestion of the disk. Arteries appeared normal. Manual tension normal. Fundus of the right eye showed tortuous and distended veins but there was no congestion of the disk. The ears, nasal chambers and pharynx were negative. There was no history of patient scratching his face or squeezing any part of it. Hemoglobin 116 per cent—18.1 gm. per 100 cc.; color index 1.1; R. B. C. 5,000,000; W. B. C. 11,900. Polynuclears 76 per cent, of which 70 per cent were mature and 6 per cent immature. Eosinophils 1 per cent; lymphocytes 20 per cent; mononuclears 3 per cent. Urinalysis negative to albumin, glucose, etc. Spinal count 3 cells. *Treatment:* 2 gm. sulfathiazole initial dose; 1 gm. q. 4. h. continued. Gr. x sodium bicarbonate given with each dose. Fluids forced. Intake as well as output measured daily. High colonic given.

Aug. 5, 1943: Hemoglobin 126 per cent; 19.6 gm. per 100 cc. W. B. C. 15,900.

Aug. 6: Temperature 98.2°. Spinal fluid and blood cultures 24 hours negative.

Aug. 8: Hemoglobin 110 per cent; 17 gm. per 100 cc. W. B. C. 10,900. Spinal and blood cultures 72 hours negative. Wassermann negative. Sulfa blood content 2.53 mg. Complete movement internal rectus as well as 50 per cent of the motion of the superior and inferior recti. Complete registration of the action of the inferior oblique as well as that of the external rectus. Salt-free diet ordered.

Aug. 9: Hemoglobin 115 per cent; 17.9 gm. per 100 cc. R. B. C. 5,100,000; W. B. C. 11,150; 58 per cent polynuclears,

of which 56 per cent were mature and 2 per cent immature; eosinophils 2 per cent; lymphocytes 39 per cent. Sulfa blood content 4.52 mg. per cent.

Aug. 10: Sulfa discontinued at night. Four to six doses daily.

Aug. 11: Hemoglobin 110 per cent; 17.2 gm. per 100 cc. Blood sulfa content 2.4 gm. per cent. X-ray showed left frontal and left ethmoidal cloudiness. Other sinuses negative.

Aug. 12: Hemoglobin 110 per cent; 17 gm. per 100 cc. R. B. C. 5,100,000; W. B. C. 9,900; polynuclears 55 per cent, of which 53 per cent were mature and 2 per cent immature; lymphocytes 42 per cent; mononuclears 2 per cent; basophiles 1 per cent. OS retinal veins straightening out. Proptosis decreasing. Sulfathiazole discontinued. Bathroom privileges permitted. Regular salt-free and low protein diet continued.

Aug. 13: Right antrum irrigated through the natural ostium, negative return. Left antrum slight amount of mucopus.

Aug. 15: Exophthalmos receded still more. Only diplopia seen upon looking upward and inward.

Aug. 18: Patient discharged from hospital. Hemoglobin 111 per cent; 17.3 gm. per 100 cc. R. B. C. 5,000,000. W. B. C. 6,400; polynuclears 68 per cent — 66 per cent mature, 2 per cent immature; eosinophils 3 per cent; basophiles 1 per cent; lymphocytes 26 per cent; mononuclears 2 per cent. Patient's eye still proptosed about one-fourth inch.

Aug. 20: V — OD 10/10 — 3; OS 10/15 with P. H. Disk 10/10 — 2. Fundus veins nearly normal in caliber. Both right and left antra irrigations negative return.

Aug. 25: Slight swelling of left upper lid. Patient had indulged in some undue exercise. Fields for white normal.

Aug. 30: Blind spot measurements show right eye somewhat reduced in the upper and outer quadrants. Left eye reduced about 2 mm. in the lower quadrant. Two millimeter object used for both fields and blind spot tests.

Sept. 9: Left fundus normal.

Sept. 22: Tests for diplopia show the external rectus motion limited to 35°; the superior rectus 35° and the superior oblique to 35°. These tests for the fields were carefully taken with the edematous upper lid held aside. I believe that this was simply reaction as a result of strenuous exercise (playing ball) taken a few days ago.

At the present writing the proptosis has practically disappeared. There is the slightest puffiness of the left upper lid present. Examination of both fundi show same to be normal. Vision OS 10/10 — 6 corrected to 10/10.

Addenda: I examined this patient on April 21, 1945, and found his vision as well as extraocular muscle movements absolutely normal.

667 Madison Avenue.

BOOK REVIEW.

Lipreading and Hearing Aids. By Irene R. Ewing, O.B.E., M.Sc. Second edition. Seventy-three pages. Manchester (15), England; Manchester University Press, 8-10 Wright Street. Price 4/6 net.

This small wartime edition was published to meet the needs of returning service personnel who have lost part or all of their hearing. The author is a hard-of-hearing teacher of lipreading who uses both lipreading and a hearing aid for successful understanding of visible speech. The book is written in simple non-professional language for the deafened adult analyzing the problems which underlie an adjustment to deafness and presenting methods of alleviation. Two courses are open providing all medical service has been rendered: lipreading for all sighted individuals, and lipreading combined with a hearing aid for those who have a usable amount of hearing. Experiments conducted at a hearing aid clinic operated by the author and her husband show that auditory and visual stimulation together produce the greatest amount of understanding by a deafened adult.

The author points out that the individual must realize that there are certain limitations to lipreading and the use of a hearing aid, but that the employment of the two will greatly facilitate their rehabilitation. A section of the books contains an encouraging picture and it is recommended for every hard-of-hearing individual and those associated with them.

J. McP.

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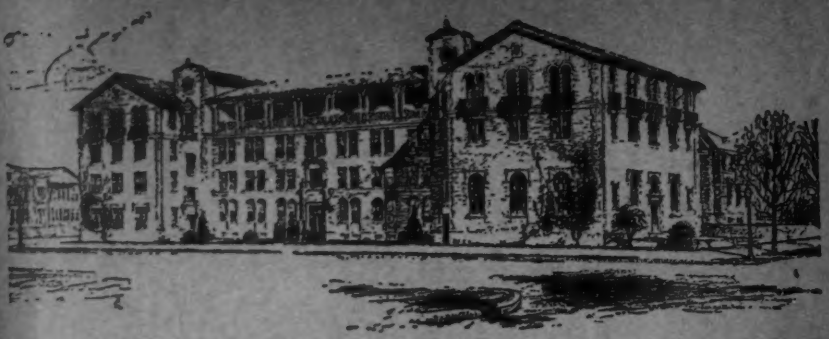

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